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THE BROWNIAN MOVEMENT.

BY H. L. BREVOORT.

(*Read January* 21*st*, 1887.)

I have from time to time for the past four years given a good deal of attention to this still unexplained movement. As you all know, small particles of any substance, when suspended in water, will show and continue to show for an indefinite period of time, a rapid movement. Apparently as long as the slide lasts, the movement will continue. I have slides some four years old and the movement is as rapid now as on the day they were mounted. Prof. Stanly Jevons says, if I remember correctly, that, he had slides over ten years old which showed the movement as when new. I have found the common water-color paint, "flake-white" to give the most satisfactory results. Rub a little of this up with water till the water is milky; then let it settle for a few minutes and decant the upper and clearer portion of the liquid. Repeat this several times. Then mount in a cell, say $\frac{1}{100}$ of an inch deep. Observe with a $\frac{1}{8}$, or still higher objective and the movement will be clearly seen. It is best to make the cell of less depth, if very high objectives are to be used. Finely powdered glass may be used in place of "flake-white." Vermilion is a good material, but the particles are so small and move so rapidly that it is difficult to observe them. Carmine does not make a lasting slide, though a very effective one while it does last. Cobalt makes a good slide, but the particles are very small. In all cases proceed to mount as directed. The difficulty is that every one uses too much material in the water. Use so little that no color is apparent to the eye in the mounted slide, or, only a tinge at most.

If a mounted slide is kept for a long time with one part lower than the other, the particles will by gravity settle and compact themselves in the low part of the cell, and then if the mass is so compact that shaking the slide will not break it, the slide is spoilt.

The stratum of water between the cover-glass and slide is not equally filled with moving particles. Most of the particles which are large enough to be observed satisfactorily are close to the slide's surface, though smaller and more rapidly moving particles are found in all parts of the stratum of water. If only these latter could be enclosed in the cell, I do not think they would ever be affected by gravity and would not form themselves into a compact mass. However, these particles are comparatively few, and it seems impossible to crowd them into a mount—they seem to require room and are not friendly.

By mounting some material upon a ruled glass slide, it will be seen by carefully focusing with a high power, that most of the moving particles are on, or, are close to the surface of the slide. There they move about, some sliding as it were, some rotating,some moving in one direction and some moving in another direction. Only the small particles seem to rotate. Almost all the particles partake of several motions at once, sliding, rotating or partly rotating, and bodily moving about at the same time. The motion cannot be described, it must be seen. The smaller globules in milk show the movement well, if the milk is confined in a cell. If not in a cell, the flowing of the milk on the slide makes the observation difficult. The standard books, such as Carpenter, Beale, etc., differ widely on this subject : Some say that heat increases and others say that heat does not affect the movement, or, rapidity of the movement of the particles. I have never found that heat affects the movement one way or the other. To this end I have illuminated the microscope by a ray of moonlight and have found the movement the same, as when a strong ray of light from a lamp was used. I have heated the slides on a hot stage up to 180° F. and above, and have found no change in the movement. I have also used non-actinic light, but have found no change. Some have attributed the movement to electricity, but it is difficult to see in what condition it could be and give such results. It is a question whether the movement would be shown unless the water was between two glasses, but I believe I have observed it in an exposed drop of fluid, but of this I am not certain.

I am under the impression that light in some way is the cause. We see the radiometer turn when a ray strikes its veins. Perhaps each of the moving particles is exposing facets, which are light and dark by turn, to the upward ray of light in the microscope, and as the particle moves, other facets are exposed, and thus as long as the ray passes, so long will the particles move. The refractive index of the water may in some way affect the facets of the particles; so also the combination of the glass slide and the water may work together to this end. Thus a facet which is bright when the particle is in one position will perhaps be dark when the particle is in another position, and thus the veins of each of these minute radiometers may be for each particle limitless in number and ever changing in hue. I have taken two bottles, subjecting them to precisely the same conditions. In each I placed water in which particles of "flake-white" were suspended. One bottle I kept in the light, day and night for a week, the other in total darkness for the same period. The bottle exposed to the light appeared at the end of the period to contain a greater number of particles moving in it than the bottle which had been in the dark. This difference was visible to the naked eye. The bottle exposed to the light being the one which contained at the end of the time the most turbid fluid. I have not been able to confirm the truth of this experiment. In fact experiments with vermilion did not show the same result, or else the difference between the bottles was so slight as not to be noticeable. These experiments could be carried on and important results could perhaps be reached through the lessons they taught. Any explanation of the mysterious movement would be of interest.

HORN AND EYE OF ARION.

BY LUDWIG RIEDERER.

(*Read January 21st*, 1887.)

Arion, Lam. is a slug or snail without shell, respiring by means of lungs. It belongs to the class of Gasteropods, Mollusks.

Like all nude snails it carries the eyes on the end of the two longer ones of their four tentacles or horns.

The horn is simply a continuation of the skin. By contraction of muscles extending from the muscles of the foot, right up through the horn to the base of the eye, this can be retracted very suddenly, deep into the body, while the horn in like way is turned over inward.

On the end plate of the horn, between epithelial cells singularly formed, is found an accumulation of sensitive cells, most likely for the sense of touch.

The eye is of the plain type, and corresponds to a Camera obscura of spherical shape, with Iris, a globular lens, retina, opposite to the side giving entrance to the light, and choroidea with pigment of black color enclosing the whole enclosed surface.

The method to prepare cuts for microscopical observation and of durability for longer time, consists in putting the (while extended) freshly cut horn in aqueous saturated solution of Corrosive Sublimate, during twenty-four hours for fixing. After this it is hardened by 95 per cent. alcohol. Another way is to fix first by immersion in solution of Osmic Acid of 0.1 per cent. for ten minutes, and to harden after in solution of Bichromate of Potash of 2 per cent. during twenty-four hours. After extracting with water it is brought in diluted alcohol, increasing the strength of this slowly till alcohol absolute.

Treated in one of these two ways it is in the known way transferred in Chloroform and Chloroform-Paraffine.

The cuts fastened to the slide may be tinted by some of the solutions of Carmine, Haematoxylin or Safranin (and enclosed), to make more distinct the different tissues.

PROCEEDINGS.

Meeting of December 3d, 1886.

The Vice-President, Mr. P. H. Dudley, in the chair.

Sixty-three persons present.

On motion the regular order of business was suspended.

Prof. Samuel Lockwood, Ph. D., was introduced to the Society, and delivered a lecture entitled, "The Life of a Diatom." This lecture was profusely illustrated by lantern slides, of remarkable excellence, by Prof. W. Stratford, of the College of the City of New York. The slides were exhibited by the lime-light, showing among many noted objects, Habishaw's photograph of *Pleurosigma*, with lines one-third of an inch broad, and beautifully clear, and views of Mr. Christian's new and very curious diatoms. The lecture is published in this Journal, in the number for December, 1886, pp. 135–142.

Meeting of December 17th, 1886.

The President, the Rev. J. L. Zabriskie, in the chair.

Forty-one persons present.

On motion the regular order of business was suspended.

The President introduced Prof. Samuel Lockwood, Ph. D., who read a paper entitled, "Raising Diatoms in the Laboratory;" giving methods and results of experiments made upon sea-water, and extending through several years; the objects being raised from spores, and carried through their entire life career. This paper was illustrated by numerous slides, shown under the microscope, and is published with an accompanying plate in this Journal, in the supplemental number for December, 1886, pp. 153–166.

Meeting of January 7th, 1887.—The Annual Meeting.

The Vice-President, Mr. P. H. Dudley, in the chair.

Twenty-four persons present.

The special committee, appointed to nominate a list of officers for the ensuing year presented their report.

The Annual Report of the President was read by the Corresponding Secretary.

The reading of the reports of the Treasurer, the Librarian and the Curator, was, on motion, postponed until the next meeting.

The resignation of Active Membership by Mr. John A. Bagley, and Prof. A. M. Mayer, was accepted.

Prof. Samuel Lockwood, Ph. D., made some remarks supplementary to his paper of December 17th, 1886, on "Raising Diatoms in the Laboratory." He dwelt particularly on the great variety of hitherto unknown forms developed in his experiments, and suggested the title—"Heterogeny of the Diatom" for his paper. He further presented a sheet of very delicately made drawings, by Prof. Alfred C. Stokes, of these curious forms.

Mr. P. H. Dudley read a paper, illustrated by photo-micrographs and specimens of the White Cedar (*Chamæcyparis sphæroidea*) showing its structure, and also showing its fungus (*Agaricus campanella*).

The President announced the closing of the polls, and the following was declared the result of the balloting:—

For President, J. L. Zabriskie.
For Vice-President, P. H. Dudley.
For Recording Secretary, H. W. Calef.
For Corresponding Secretary, B. Braman.
For Treasurer, C. S. Shultz.
For Librarian, A. Woodward.
For Curator, W. Beuttenmüller.
For Auditors, F. W. Devoe, W. R. Mitchell, F. W. Leggett.

Meeting of January 21st, 1887.

Mr. B. Braman, President *pro tem.*, in the chair.

Twenty persons present.

Summary of the Report of the Treasurer, Mr. Charles S. Shultz.

Balance, Jan. 15th, 1886	$122.69	
Receipts, to Jan. 7th, 1887	337.50	$460.19
Disbursements to Jan. 7th, 1887		381.08
Balance, Jan. 7th, 1887		$79.11

Drs. Frank M. Hoyt and H. Fearn were elected Active Members, and Prof. A. M. Mayer was elected a Corresponding Member of the Society.

On motion, the names of the following persons designated as Associate Members under the old Constitution and By-Laws, were directed to be printed in the forthcoming list of members of the Society as Corresponding Members ; viz.:—

D. F. BRIGGS, M. D., Germantown, Pa.
Prof. W. WHITMAN BAILEY, Brown University, Providence, R. I.
ALBERT H. CHESTER, Hamilton College, Clinton, N. Y.
ANTONIO DE GORDON Y ACOSTA, Havana, Cuba.
EUGENE MAULER, Travers, Switzerland.
CARL SEILER, Philadelphia, Pa.
CHARLES L. SWASEY, New Bedford, Mass.
THOMAS TAYLOR, M. D., Washington, D. C.
JAMES W. WARD, Grosvenor Library, Buffalo, N. Y.

On motion, the Society ordered the following names of Honorary Members to be printed, in the forthcoming list of Members, as the Honorary Members of the Society under the new By-Laws, viz.:—

Prof. HAMILTON L. SMITH, Geneva, N. Y.
J. H. MORTIMER, 113 Maiden Lane, N. Y. City.
Hon. JACOB D. COX, Cincinnati, Ohio.
FRANK CRISP, LL.B., London, England.

On motion, it was resolved that the names of the former Active Members of the Society be printed in the same list as Resident Members.

The Corresponding Secretary, Mr. B. Braman, reported the receipt of a gift of nine Photographs, from Dr. Henri Van Heurck, with an accompanying description. The said photographs were taken with an apo-chromatic No. 10, Zeiss homogeneous immersion lens—power, 800 diameters—and a further magnification of the same to 3,000 diameters. The Corresponding Secretary read the description, and exhibited the photographs of *P. angulatum*, *S. gemma*, and *A. pellucida*.

On motion, the thanks of the Society were tendered Dr. Henri Van Heurck, for these well executed and instructive photographs.

Mr. H. L. Brevoort addressed the Society on the Brownian

Movement, illustrated by drawings on the black-board. This address is published in full in the present number of this Journal.

OBJECTS EXHIBITED.

The objects exhibited were :

1. Vanessa ; sections through the head : by L. RIEDERER.

2. Arion ; sections through the eye : by L. RIEDERER.

3. Larva of Lace-wing Fly : by F. W. LEGGETT.

4. Head and Jaws of Lace-wing Fly : by F. W. LEGGETT.

5. *Arachnoidiscus Ehr.*, plated with gold ; mounted by A. Y. Moore : by C. S. SHULTZ.

6. Arranged Diatoms : by C. S. SHULTZ.

The Chairman announced a course of Lectures to be given at Columbia College, to which the Members of the Society were invited.

MEETING OF FEBRUARY 4TH, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Seventeen persons present.

Mr. Arthur H. Sleigh was elected a Resident Member of the Society.

OBJECTS EXHIBITED.

1. Cray-fish (*Astacus fluviatilis*) ; sections through the organs: by L. RIEDERER.

Of these sections, the muscles were mounted in glycerine, and the remainder in balsam, showing *vas deferens* with ciliated cells. Also the sexual organs, showing spermatozoa. Mr. Riederer explained at length his methods of section-cutting and staining.

2. *Closteria ; Epistylis*, *Cephalosiphora* and *Limnias :* by W. G. DE WITT.

3. Brucine ; by polarized light : by M. M. LE BRUN.

4. Section of Granite ; by polarized light : by T. B. BRIGGS.

Messrs. Hyatt and Briggs explained their methods of cutting sections of minerals.

The President expressed his thanks for his reëlection to office, and urged upon the members the need of greater efforts during the current year in the matter of exhibition of objects.

Meeting of February 18th, 1887.

On account of a severe storm only seven persons were present. There being no quorum the meeting was informal.

Annual Reception of 1887.

The Ninth Annual Reception of the Society was held at Lyric Hall, 723 Sixth Avenue, on the evening of March 4th, 1887.

Regularly disposed in the large auditorium were ten tables, holding fifty-two microscopes, with their respective objects, displayed and explained by thirty-four exhibiting members. The large adjoining hall, in which was stationed an excellent orchestra, afforded additional space for the movement and social intercourse of a larger number of visitors than had ever been welcomed on any previous similar occasion.

THE OBJECTS EXHIBITED WERE AS FOLLOWS:

1. Widmannstatten Figures on Meteoric Iron, from Glorieta Mountain, New Mexico: by George F. Kunz.
2. Essonite, or Cinnamon Garnet: by George F. Kunz.
3. Cyclosis in Nitella: by W. R. Mitchell.
4. *Trichina spiralis:* by L. Schöney, M. D.
5. Platino-cyanide of Magnesium: by G. S. Woolman.
6. Fern-leaf Gold Crystals: by G. S. Woolman.
7. Spiral Fibre from the Fruit-stalk of the Banana (*Musa sapientum*), by polarized light: by the Rev. J. L. Zabriskie.
8. Brownian Movement: by H. L. Brevoort.
9. Plant-hairs of Sea Buck-Thorn (*Hippophaë rhamnoides*): by C. F. Cox.
10. Plant-hairs of Yellow Water-Lily (*Nuphar advena*): by C. F. Cox.
11. Spider's Silk; shown in comparison with No. 120 spool cotton: by F. W. Devoe.
12. Cyclosis in Vallisneria: by F. W. Devoe.
13. Arranged Diatoms: by F. W. Devoe.
14. Head of a Moth: by William Wales.
15. Globules of Copper, ejected from a Siberian Volcano: by William Wales.
16. Tongue of House-fly (*Musca domestica*): by William Wales.

17. Feathered-oar of Water-Boatman (*Notonecta undulata*) : by A. G. LEONARD.

18. *Sphæria pilifera*, on Yellow Pine : by P. H. DUDLEY.

19. *Pencillium glaucum*. on Potato : by CHARLES E. PELLEW.

20. *Bacillus anthrax*, in blood of Mouse : by CHARLES E. PELLEW.

21. Scales from wing of Mosquito : by W. H. BATES, M. D.

22. Moving Crystals of Tartrate of Lime : by H. M. DICKINSON.

23. Section of Human Scalp : by H. M. DICKINSON.

24. Section of Stigmaria, Coal fossil from Oldham, England : by F. W. LEGGETT.

25. Bouquet of Butterfly Scales : by C. W. MCALLISTER.

26. Arranged Diatoms : by C. W. MCALLISTER.

27. Circulation of Blood in the tail of a Fish : by WALTER H. MEAD.

28. Siliceous Framework of Cuticle of *Equisetum*, or Scouring-Rush : by BENJAMIN BRAMAN.

29. "File" of Katydid (*Platyphyllum concavum*, Harris): by BENJAMIN BRAMAN.

30. Circulation of Blood in the Frog : by J. L. WALL.

31. Some living animals from our Croton water : by W. E. DAMON.

32. Plant-hairs, on *Deutzia scabra* : by W. E. DAMON.

33. Brucine : by F. COLLINGWOOD.

34. Foraminifera from the Harlem river : by A. WOODWARD.

35. A Group of Insect Eggs : by M. M. LEBRUN.

36. Crystals of Silver : by M. M. LEBRUN.

37. Section of Coniferous Wood from Stomach of Mastodon : by H. W. CALEF.

38. Feather of Sun-Bird (*Cinnyris*): by H. W. CALEF.

39. Comma Bacillus of Asiatic Cholera : by LUCIUS PITKIN.

40. Sting of Wasp, with Poison Gland attached : by J. A. CHAMBERS.

41 and 42. Pond-life : by W. G. DEWITT.

43. Ovipositor of Saw-fly (*Cimbex connata*): by LUDWIG RIEDERER.

44. Fibrous Malachite with Azurite (Carbonates of Copper): by C. S. SHULTZ.

45. Hydra viridis : by C. S. SHULTZ.

46. Cilia of Mussel : by J. D. HYATT.

47. Pulmonary Tracheæ of Drone-Fly: by EDWARD G. DAY.

48. Capillaries in Human Lung : by EDWARD G. DAY.

49. Composite Cluster Cups (*Æcidium compositarum*): by GEORGE E. ASHBY.

50. Sporangia of *Aspidium ascendens :* by E. B. GROVE.

51. Arranged Diatoms: by MARK H. EISNER.

52. Head of Wasp, showing the Mouth-parts : by MARK H. EISNER.

MEETING OF MARCH 18TH, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Thirty-two persons present.

In the absence of the Secretary, Mr. M. M. LeBrun was appointed Secretary *pro tem.*

On motion, the following recommendation of the Board of Managers was adopted :—

That the number of microscopic objects exhibited at each regular meeting of the Society shall never be fewer than nine.

That the Curator, or, in his absence, the Librarian, shall, under the Curator's direction, be responsible for the exhibition of the said number of objects ; that the Curator shall prepare the list of objects, with suitable descriptive text, in season for publication by the Committee on Publications ; and that for the said services the Curator shall be paid, out of the Society's Treasury, compensation at the rate of fifty dollars per annum.

Dr. Henri Van Heurck was elected an Honorary Member of the Society.

The President appointed the Committees for the current Society-year as follows :—

I. THE STANDING COMMITTEES.

1. *On Admissions :* J. D. HYATT, WM. WALES, F. W. DEVOE, F. W. LEGGETT, W. E. DAMON.

2. *On Publications :* F. W. LEGGETT, LUCIUS PITKIN, E. B. SOUTHWICK, P. H. DUDLEY, W. H. MEAD.

II. SPECIAL COMMITTEES.

1. *On Entomology*: J. D. HYATT.

2. *On Improvements in Microscopes and Microscopical Apparatus:* WM. WALES.

3. *On Medical Science:* L. SCHÖNEY, M. D.

4. *On Mineralogy:* A. A. JULIEN, Ph. D.

5. *On Cryptogamic Botany:* C. VAN BRUNT.

6. *On Phanerogamic Botany:* N. L. BRITTON, Ph. D.

7. *On Adulterations:* B. BRAMAN.

8. *On Structure of Materials:* P. H. DUDLEY, C. E.

9. *On Textile Fibres:* H. L. BREVOORT.

10. *On Bacteriology:* C. E. PELLEW, M. E.

Mr. W. H. Mead requested to be excused from service on the Committee on Publications, and, on motion, it was resolved that the President be substituted in his place on said Committee.

The resignation of Resident Membership by Gen. Wager Swayne was presented and accepted.

OBJECTS EXHIBITED.

Mr. J. D. Hyatt exhibited the following objects, representing the Cretaceous Formation of Alabama:—

1. A supposed new Infusorial Earth.

2. Tripoli Rock, containing Micro-fossils.

3. A Coal Shale, containing Jaws and Teeth of Microscopic Animals.

4. A Bituminous Shale, filled with Spicules of Sponge.

5. A true Chalk, containing Fossils similar to those of the English Chalk.

6. Lithographic Stone, containing numerous Foraminifera.

7. Specimens of Silicified Wood.

There were also exhibited:—

8. Proboscis of Drone-fly.

9. Proboscis of Blow-fly.

10. A Polyporus from Panama: by P. H. DUDLEY.

11. A gigantic Cockroach, from Panama: by P. H. DUDLEY.

12. Eggs of Lepidoptera: by WM. BEUTTENMÜLLER.

Prof. Samuel Lockwood, Ph. D., addressed the Society on casts found in the Cretaceous clays of New Jersey.

PUBLICATIONS RECEIVED.

The American Monthly Microscopical Journal: Vol. VII., No. 12 (December, 1886), Vol. VIII., Nos. 1-5 (January-May, 1887); pp. 120.

The Microscope: Vol. VI., No. 12 (December, 1886), Vol. VII., Nos. 1-4 (January-April, 1887); pp. 152.

Bulletin of the Torrey Botanical Club: Vol. XIII., No. 12 (December, 1886), Vol. XIV., Nos. 1-5 (January-May, 1887); pp. 130.

Journal of Mycology: Vol. II., No. 12 (December, 1886), Vol. III., Nos. 1, 2, 3, and 5 (January, February, March, and May, 1887); pp. 60.

Drugs and Medicines of North America: Vol. II., Nos. 2 and 3 (September and December, 1886); pp. 62.

Dr. Thomas Taylor's Reply to Science. Relating to the Crystals of Butter, Animal Fats, and Oleomargarine: 1886; pp. 8.

Indiana Medical Journal: Vol. V., Nos. 6-11 (December, 1886–May, 1887); pp. 136.

The West-American Scientist: Vol. III., Whole Nos. 20-24 (December, 1886–April, 1887); pp. 106.

The Hoosier Naturalist: Vol. II., Nos. 3-10 (October, 1886–May, 1887); pp. 125.

Anthony's Photographic Bulletin: Vol. XVII., Nos. 23 and 24 (December, 1886), Vol. XVIII., Nos. 1-10 (January–May, 1887); pp. 382.

The Hahnemannian Monthly: Vol. VIII., No. 12 (December, 1886), Vol. XXII., Nos. 1-3 (January–March, 1887); pp. 256.

The Cosmopolitan: Vol. II., No. 1 (September, 1886); pp. 66.

Proceedings of the Natural Science Association of Staten Island: December, 1886–April, 1887; pp. 10.

Johns Hopkins University, Baltimore, Md. Studies from the Biological Laboratory: Vol. III., No. 9 (February, 1887); pp. 18. Circulars: Vol. VI., Nos. 54-57 (December, 1886–April, 1887); pp. 52.

Department of the Interior. U. S. Geological Survey, J. W. Powell, Director. Mineral Products of the United States: Calendar years 1882, '83, '84 and '85.

The Electrician and Electrical Engineer: Vol. V., No. 60 (December, 1886), Vol. VI., No. 61 (January, 1887); pp. 80.

National Druggist: Vol. IX., Nos. 23-26 (December, 1886), Vol. X., Nos. 1-21 (January–May, 1887); pp. 310.

Grevillea: Vol. XV., Nos. 74 and 75 (December, 1886, and March, 1887); pp. 101.

The Naturalist: Nos. 137-141 (December, 1886–April, 1887); pp. 158.

The Naturalist's World: Vol. III., No. 36 (December, 1886), Vol. IV., Nos. 37-40 (January–April, 1887); pp. 94.

Bulletin de la Société Royale de Botanique de Belgique: Vol. XXV., Fasc. 1 (1886); pp. 398. Comptes-Rendus des Séances: November 13th, 1886–March 12th, 1887; pp. 49.

The Microscopical Bulletin and Science News: Vol. III., No. 6 (December, 1886), Vol. IV., No. 1 (February, 1887); pp. 16.

Brooklyn Entomological Society. Entomologica Americana: Vol. II., Nos. 9-12 (December, 1886–March, 1887), Vol. III., Nos. 1-3 (April–June, 1887); pp. 135.

The Botanical Gazette: Vol. XI., No. 12 (December, 1886), Vol. XII., Nos. 1-5 (January–May, 1887); pp. 158.

Monatsblätter des Wissenschaftlichen Club in Wien: Vol. VIII., Nos. 2-8 (November, 1886–May, 1887); pp. 68. Jahresbericht: 1886-1887 (Eleventh year); pp. 45. Ausserordentliche Beilage: Nos. 1-4; pp. 56.

Chronik des Wiener Gothe-Vereins: Vol. I., Nos. 2 and 3 (November and December, 1886), Vol. II., Nos. 4-8 (January–May, 1887); pp. 36.

Bulletin of the Washburn College Laboratory of Natural History: Vol. I., No. 7 (December, 1887); pp. 24.

Massachusetts Horticultural Society: Schedule of Prizes offered for the year 1887; pp. 42.

JOURNAL

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THE LARVA OF THE CHRYSOPA.

BY F. W. LEGGETT.

(*Read January 21st*, 1887.)

Of the Chrysopa (Lace-wing Fly), of which the two specimens I exhibit are the larva, Packard says "the body is slender, with delicate gauze-like wings, and it is generally green with golden eyes. When disturbed it emits a fœtid odor, its eggs supported by long pedicels, are often laid in a group of aphides or on plants infested by them. When hatched the voracious larva finds its food ready at hand, and destroys immense numbers of plant-lice, whence its name "Aphis Lion." It turns to a pupa late in summer, and thus passes the winter within a very dense round whitish cocoon, situated in the crevice of bark. In Europe, gardeners search for these Aphis Lions, and place them on fruit trees overrun with lice, which they soon depopulate." There are two peculiarities about this insect which I do not find noted in authorities consulted. First, retained powers of locomotion while in their white cocoon-like covering, for the pair I have here this evening fell on my hand when riding, and would have been brushed off as a particle of floating wool had I not noticed that they were moving rapidly away. Secondly, they have four distinct mandibles, two on either side of the head, those on the same side being flat on the inner and rounded on the outer surface, fitting so closely and accurately together, that when not in use and crossed, as they appear under one of the microscopes, the dividing line is not perceptible. These mandibles are formidable weapons, being about one-quarter the length of the body. I have read somewhere, but am unable to find it, that this white

silky covering is not a cocoon spun by the occupant, but is borrowed for the purpose of disguise, and the little "varmint" is a veritable wolf in sheep's clothing. As this covering is composed of all sorts of odds and ends, it lends color to this fiction—if fiction it be.

The specimen under the inch objective, has been bleached in potash, and is mounted in balsam. That under the two inch is as found, except that its covering has been disturbed so as to show the mandibles in a position of rest.

NOTE ON THE FORAMINIFERAL FAUNA OF THE MIOCENE BED AT PETERSBURG, VIRGINIA; WITH LIST OF SPECIES FOUND.

BY ANTHONY WOODWARD.

(*Read May 6th*, 1887.)

The evidence of the very remarkable abundance of Foraminifera in the Miocene bed at Petersburg, Virginia, was found by me accidentally while examining some coarse material from between two valves of Pectunculus lentiformis, Conrad, containing by weight ½ oz. of sand and fragments of shells.

This specimen, formerly the property of Mr. C. M. Wheatly, an old collector, has lain undisturbed in the private collection of Mr. Sanderson Smith for over thirty-five years.

By a hasty glance with a hand lens, I saw that the material was very rich in foraminifera. On a second and more careful examination, with the aid of the microscope, I identified the following genera and number of species:

Spiroloculina, 2; *Miliolina*, 1; *Lagena*, 1; *Cristellaria*, 1; *Discorbina*, 2; *Anomalina*, 2; *Pulvinulina*, 1; *Nonionina*, 3; *Polystomella*, 1; *Amphistegina*, 1.

The last named genus was found in such numbers that it almost equals the great Amphistegina beds at Nussdorf, near Vienna, Austria. It is also found in Maryland, South Carolina and Alabama.

List of species and the number of each found:

Spiroloculina planulata, Lamarck, sp., 1.

Spiroloculina limbata, d'Orbigny, 2.

Miliolina seminulum, Linné, sp., 26.
Miliolina oblonga, Montagu, sp., 2.
Miliolina venusta, Karrer, sp., 15.
Miliolina tricarinata, d'Orbigny, sp., 16.
Miliolina subrotunda, Montagu, 1.
Miliolina bicornis, Walker and Jacob, sp., 1.
Lagena aspera, Reuss, 1.
Cristellaria italica, Defrance, 1.
Discorbina orbicularis, Terquem, sp., 2.
Discorbina bertheloti, d'Orbigny, 3.
Truncatulina lobatula, Walker and Jacob, sp., 7.
Truncatulina dutemplei, d'Orbigny, 1.
Anomalina grosserugosa, Gümbel, sp., 4.
Anomalina ariminensis, d'Orbigny, sp., 7.
Pulvinulina canariensis, d'Orbigny, sp., 1.
Nonionina depressula, Walker and Jacob, sp., 2.
Nonionina umbilicatula, Montagu, sp., 3.
Nonionina seapha, Fichtel and Moll, sp., 10.
Amphistegina lessonii, d'Orbigny, 2,000.
Total, 2,106.

From these figures I am inclined to believe that the microscopic life in the miocene period must have exceeded the fauna of our waters of the present age.

The water in the miocene age evidently was shallow and warm, as Amphistegina is not found so plentifully, only under these conditions, in the tropical regions.

The Amphistegina of the Virginia miocene bed are not so large and robust as the ones from Nussdorf, but much larger than the living species.

PROCEEDINGS.

Meeting of April 1st, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Thirty-one persons present.

A new form of programme for the regular meetings, containing an extended explanation of the objects announced for exhibition, recommended by the Board of Managers and issued by the Committee on Publications, was approved by the Society.

The resignation of Resident Membership, by Mr. Max Levy, was accepted by the Society.

Mr. George E. Ashby presented for the Cabinet of the Society four slides of Sections of Agate.

Mr. J. D. Hyatt addressed the Society on the similarity between the structure and inclusions of Furnace Slag, exhibited by him, and those of Obsidian, heretofore believed to be characteristic of the latter substance.

Mr. Wm. Wales exhibited Photo-micrographs by Mr. Wright, taken under a magnification of from 40 to 400 diameters.

Mr. A. Woodward read a Paper on Kaolin, with reference to its antiquity and uses.

Mr. C. S. Shultz read a letter written by Mr. Max Levy, enclosing Photo-micrographs, which latter were exhibited to the Society.

Mr. A. Woodward exhibited a collection of Photo-micrographs, made by the late Dr. J. J. Woodward.

Mr C. F. Cox remarked that, with all the improvements that had been made, during late years, in the construction of lenses, it was noticeable that the quality of Dr. Woodward's work in photography, had not been materially excelled. He thought, for example, that no better photograph of Surirella gemma had ever been taken than this one of Dr. Woodward's. In one respect, however, workers with the camera had learned a good lesson, and that was to let their negatives alone after they were once taken. For scientific purposes the value of their work was much impaired by any treatment given the negative itself. Dr. Wood-

ward was justly criticised for painting out the back-ground and surrounding objects in his earlier photographs. But even he profited by criticism as his very latest work shows.

Mr. Shultz remarked that he had a photograph of Surirella gemma taken by Dr. Van Heurck which he thought was better than Dr. Woodward's.

Mr. Cox replied that perhaps he had not seen the particular photograph referred to, but that he thought Dr. Van Heurck's work generally showed evidence of very decided manipulation of the negatives, which was greatly to be regretted. He said it was a coincidence that the subject of photography was under discussion at a recent meeting of the Royal Microscopical Society, and that substantially this same criticism was made upon Dr. Van Heurck's work, which he had just made.

Mr. Cox further remarked that he thought it might be a subject not only of general interest in connection with this discussion, but also of society pride in a fellow-member, if he should say that he had recently received testimony from a gentleman, who makes good use of the camera and of the best modern objectives, that much of his most satisfactory photographic work is still done with a fifteenth, made by Mr. William Wales about twenty years ago.

On motion, it was resolved that the Committee on Publications be instructed to publish the Journal of the Society as a Quarterly.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

1. Moss Agate : by GEO. E. ASHBY.
2. Blood-stone : by GEO. E. ASHBY.
3. Eggs and Scale of *Mytilapsis pomorum*, Bouche. The Oyster-shell Bark-louse of the Apple : exhibited by W. BEUTTENMULLER.

The scale insects, or bark-lice, belong to the family known to entomologists as the *Coccidæ*. This is a division of the sub-order *Homoptera*, to which belong also the plant-lice (*Aphides*), the *Cicadas*, the leaf-hoppers, and certain other insects. One of the most common and injurious bark-lice is *Mytilaspis pomorum*, which infests the apple, and does more injury to that tree than any other insect known. (?) It is also found on the following

trees and plants: linden, hop-tree, horse-chestnut, maple, locust, raspberry, pear, plum, hawthorn, currant, ash, elm, hackberry, willow, poplar, and yucca, etc., etc.

There is but a single generation of this species each year in the North, where the eggs hatch in the latter part of May or early in June, and two generations in the South. The female lays from twelve to one hundred white eggs under the scale. The young at first are reddish, and resemble mites. They run over the twigs and leaves, and in two or three days fix themselves to one spot, settle for life, and suck the sap of the tree.

4. Eggs and Scale of *Chionaspis Pinifoliæ*, Fitch. The Pineleaf Scale-Louse: exhibited by W. BEUTTENMULLER.

This species, which belongs to the same family as the preceding, infests the leaves of various species of pines and spruces throughout the eastern United States, from New York to Florida. The female lays from twenty-five to thirty-five pinkish, oval eggs, which are crowded in the scale. When the female has laid all her eggs, she dies and dries up at the smaller end of the scale.

5. Steel from Tire of a Locomotive Driving Wheel: exhibited by P. H. DUDLEY.

The size of the so-called "Crystals" is the largest of any yet seen by the exhibitor in rolled or hammered steel. The tire did not have sufficient tensile strength to stand the usual shrinkage of other tires, and broke after being put on the wheel, while standing in the shop.

6. Section of Furnace Slag containing Crystal and Microliths: exhibited by J. D. HYATT.

OBJECTS FROM THE SOCIETY'S CABINET.

7. "Challenger" soundings, 1850 fathoms.

8. Diatoms from Santa Monica.

9. Palate of *Buccinum obsoletum*.

The palate, tongue, or odontophore, as it is sometimes designated, is a very interesting object, though quite unlike the tongue or palate of the higher animals.

Carpenter says: "It is a tube that passes backwards and downwards beneath the mouth closed at its hinder end, whilst in front it opens obliquely upon the floor of the mouth, being (as it were) slit up and spread out so as to form a nearly flat

surface. On the interior of the tube, as well as on the flat expansion, we find numerous transverse rows of minute teeth which are set upon flattened plates, each principal tooth sometimes having a basal plate of its own, while in other instances one plate carries several teeth. The former applies to the terrestrial Gasteropods, while the latter to the marine Gasteropods" (as general rules).

Buccinum obsoletum, belonging to the latter, apparently shows three rows of plates, a central row having small teeth, while each outer one has large lateral teeth. Each distinct, arched transverse plate of the central row has seventeen curved but sharp-pointed teeth, the centre one being the largest. It is stated that the *Buccinum* (Whelk) and its allies use the flattened portion of their palates as a file, with which they bore (?) holes through the shells of the mollusks, that serve as their prey.

In the specimen the teeth on one end of the palate are much worn, showing that it has been used as a cutting or grinding instrument.

QUERY.—Is the cutting done by a pushing or drawing stroke?

10. Hair of Chinchilla.

11. Hair of Mouse.

12. Tingis Hyalina.

13. Proboscis of *Tabanus Atratus* (horse-fly).

14. Section of Stomach (?) of Cat (injected).

15. *Salisburia Adiantifolia* (Ginkgo tree): portion of leaf (stained).

The tree, native of China and Japan, has broad, fan-shaped leaves, parallel-veined, while the structure of the wood is quite similar to the Conifers, having needles, or narrow parallel-veined leaves. The leaves have an abundance of stomata, while the so-called veins are composed of spiral (tracheal) tissue. It is quite a distinct and exceptional type of tree. Its fruit is a drupe.

Fine specimens of the tree can be seen in Central Park and in Boston Common.

MEETING OF APRIL 15TH, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Thirty persons present.

The Corresponding Secretary, Mr. B. Braman, presented to the Society cards of admission to, and programmes of the Public Reception of the Brooklyn Microscopical Society, to be held at the Adelphi Academy in Brooklyn, on the evening of April 19, 1887.

On motion it was resolved that the thanks of this Society be tendered the Brooklyn Microscopical Society, for this kind invitation to attend the said reception.

Dr. Frank D. Skeel and Mr. Charles L. Tiffany were elected Resident Members of the Society.

Dr. N. L. Britton announced the proposed Thirty-sixth Meeting of the American Association for the Advancement of Science, to be held in this city on the 10th of August, proximo.

On motion of Mr. B. Braman, it was resolved, that the request of the New York Academy of Sciences, for the formation of a Local Committee of Arrangements, for the reception of the American Association for the Advancement of Science, be acceded to; and that, to this end, the President of this Society be requested to appoint delegates to represent the Society, at a meeting of such committee, to be held on the evening of May 30th, at the Hotel Brunswick, in this city.

The President appointed such delegates as follows:—P. H. Dudley, F. W. Devoe, and C. E. Pellew; and as substitutes, F. W. Leggett, C. Van Brunt and A. A. Julien.

On motion, it was resolved that the President be added to the number of such delegates.

The resignation of Resident Membership, by Dr. Frank Odell was accepted.

Dr. N. L Britton exhibited, *Trichomes* from leaf of American Mistletoe, and remarked upon the abundance of chlorophyll which was found, even in the pith of the plant.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

1. Sori (or fruit-dots) of *Hemitelia horrida*, from Jamaica, W. I.: exhibited and described by Mr. E. B. Grove.

The indusium (or involucre) in this fern takes the form of an egg-shaped capsule, surrounding the *sporangia* (or spore cases), opening at the summit at maturity to allow the expanding of the *sporangia*. It resembles a small *Hydra* or a small *Octopus*:

hence the exhibitor thinks its specific name *horrida*, and, further, believes it is confined to the West Indies.

2. Cocoon of Ichneumon—Parasitic on Larvæ of *Orgyia Leucostigma*, Harris: exhibited and described by Mr. E. B. GROVE.

It is a free cocoon formed outside of the body of the larvæ or cocoons of the female of *O. leucostigma* (have never noticed any on the larvæ or cocoons producing the male imago). The material of which it is composed resembles spun-glass. Imago (or perfect-fly) escapes through a peculiar trap-door arrangement at upper end of cocoon.

3. *Mucor Racemosus* growing *en masse:* exhibited and described by Mr. CHARLES E. PELLEW, M. E.

4. *Mucor Racemosus* (*sporangia*), isolated and mounted: exhibited and described by Mr. CHARLES E. PELLEW, M. E.

A not uncommon form of Mould, distinguished from others by its extremely rapid growth. The mycelium is at first white, but turns dark-colored when the *sporangia* ripen. This variety has proven a serious source of contamination of "Cultures" in the "School of Mines Laboratory" the past winter.

The Moulds are interesting microscopic objects for study, and can be readily cultivated. The air is so full of spores of various species, that a piece of bread moistened with water, and put under a tumbler or bell-glass in a room of 60° to 80° Fahr., will in two or three days have several spots of Mould.

A small fragment of meat boiled and kept in a moist condition, and covered as above, will show a growth of Moulds in a day or two.

The function of the Moulds is to destroy the substances upon which they grow. They are unbuilders, and to prevent their growth, and that of *Microbes*, upon fresh meats, these must be kept at a temperature below that in which the spores can germinate.

5. Proboscis of Blow-fly: (?) exhibited by Mr. A. G. LEONARD.

6. Sea Life : exhibited and explained by Mr. M. M. LEBRUN.

7. *Blatta Orientalis*, Harris, Cockroach: exhibited and explained by Mr. F. W. LEGGETT.

8. Reticulation of the Tunics of *Crocus Vernus*, Allione : exhibited and described by Mr. E. B. SOUTHWICK.

This crocus belongs to the spring-flowering species and the

Involucrate division, with a basal spathe springing at the base of the scape from the summit of the corm. The "Reticulati Section" has a corm tunic of distinctly reticulate fibers.

The corm is oblate, from one-half to three-fourths of an inch in diameter, and three-eighths to one-half an inch high, the tunic finely reticulated, while the basal tunic covering the lower half of the corm is composed of unbranched radiating fibers. The specimens show the reticulation of the cap, main and basal tunics.

OBJECTS FROM THE SOCIETY'S CABINET.

9. *Heliopelta* (Diatom).

This specimen is one of the type having two radial divisions, the central star being five-pointed. It differs in many essential features from the one given by Carpenter, in Plate I, Fig. 3, between the 14th and 15th pages of his sixth edition of the "Microscope and its Revelations,"—description pages 350 and 351. Five of the radial divisions have *hexagonal areolæ*, while in the five which alternate with them, the areolation is formed by equilateral triangles; the points of the star extend into the radial divisions, having the triangles, instead of in the other form, as shown by Carpenter. The beaded appearance on under plate is plainly seen.

The dark corners, which Carpenter figures as divided equally between the two types of the radial divisions, in this specimen are confined to the corners of the radial divisions marked by the equilateral triangles. It is the latter divisions which are depressed, though they are above the border of the rim.

The specimen is 225 micras in diameter.

10. Gizzard of a Cricket.

Shows several rows of horny teeth, (?) which are used in the reduction of its food.

11. Precious Serpentine.

(Polariscope Object.)

PUBLICATIONS RECEIVED.

The Journal of Microscopy and Natural Science: Vol. VI., Pts. 21 and 22 (January and April, 1887); pp. 132.

Field Naturalists' Club of Victoria, Australia. The Victorian Naturalist: Vol. III., Nos. 5-12 (September, 1886–April, 1887); pp. 120.

Bulletin de la Société Belge de Microscopie: Vol. XII., Nos. 10 and 11 (July and October, 1886), Vol. XIII., Nos. 1-4 (October, 1886–January, 1887), No. 6 (March, 1887); pp. 148.

Smithsonian Institution: Annual Report of the Board of Regents for the year 1884, Pt. II., pp. 458.

Notes on Histological Methods; pp. 36. By Simon H. Gage.

The Source of the Mississippi (Reprinted from *Science*); pp. 16.

The Journal of the Cincinnati Society of Natural History: Vol. IX., No. 4 (January, 1887), Vol. X., No. 1 (April, 1887); pp. 115.

Journal of the Trenton Natural History Society: Vol. I., No. 2 (January, 1887); pp. 44.

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Proceedings of the Newport Natural History Society: 1885-6, Document 4; pp. 30.

Bulletin of the American Museum of Natural History: Vol. I., No. 8 (December 28th, 1886); pp. 56.

Le Moniteur du Praticien: Vol. II., No. 12 (December 15th, 1886), Vol. III., No. 1 (January 25th, 1887); pp. 56.

Journal of the Royal Microscopical Society: Ser. II., Vol. VI., Pt. 6a (December, 1886), 1887, Pts. 1 and 2 (February and April); pp. 465.

Transactions of the Connecticut Academy of Arts and Sciences: Vol VII., Pt. 1 (1886); pp. 259.

School of Mines Quarterly: Vol. VIII., Nos. 2 and 3 (January and April, 1887); pp. 196.

Journal and Proceedings of the Royal Society of New South Wales for 1885: Vol. XIX.; pp. 49+240.

Ottawa Field Naturalists' Club: Vol. II., No. 3 (1885-6); pp. 85.

The Ottawa Naturalist: Vol. I., Nos. 1 and 2 (April and May, 1887); pp. 32.

Journal and Proceedings of the Hamilton (Canada) Association: Vol. I., Pt. 3 (1885-6); pp. 324.

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Bulletin de la Société Impériale des Naturalists de Moscou: Vol. LXII., Nos. 2 and 3 (1886); pp. 540.

Annals of the New-York Academy of Sciences: Vol. III., Nos. 11 and 12 (September, 1886); pp. 76. Transactions: Vol. V., Nos. 7 and 8 (April and May, 1886); pp. 106.

The Canadian Record of Science: Vol. II., No. 6 (April, 1887); pp. 64.

North Staffordshire Naturalists' Field Club. Annual Report, 1886; pp. 154.

New Treatment of the Affections of the Respiratory Organs and of Blood Poison, by Rectal Injections of Gases, After the Method of Dr. Bergeon; pp. 21. By Dr. V. Morel. Translated from the French, by L. E. Holman.

FROM DR. HENRI VAN HEURCK.

Le nouvel objectif $\frac{1}{8}$e à immersion dans l'essence de cèdre de M. Carl Zeiss; pp. 5.

Ross's Patent Stand; pp. 4.

La chambre claire du Dr. J. G. Hoffman; pp. 4.

Note sur les objectifs à immersion homogène. Formules de nouveaux liquides propres à cette immersion; pp. 10.

La Lumière Électrique appliquée aux Recherches de la Micrographie; pp. 19.

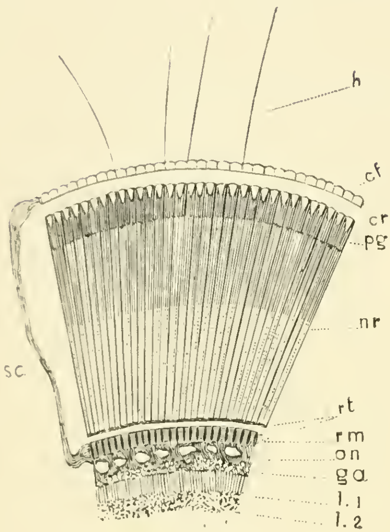
De l'emploi du styrax et du liquidambar en remplacement du baume du Canada; pp. 5.

Le Microscope à l'Exposition Universelle d'Anvers; pp. 35.

Notice sur une série de photomicrogrammes faits en 1886; pp. 6.

Nouvelle préparation du medium à haut indice (2, 4) et note sur le liquidambar; pp. 5.

Comparateur à employer dans les recherches microscopiques; pp. 3.



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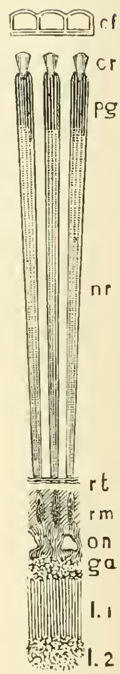

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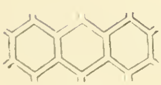

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J. L. Z. Del. ad Nat. et Sc.

THE COMPOUND EYE OF VANESSA IO, L.

JOURNAL

OF THE

NEW-YORK MICROSCOPICAL SOCIETY.

VOL. III. JULY, 1887. No. 3.

THE COMPOUND EYE OF VANESSA IO, L.

BY LUDWIG RIEDERER.

(*Given May 6th*, 1887.)

In making a full series of continuous sections through the head of an insect with compound eyes, a lepidopter for instance, if we begin in a plane adjacent to and parallel with the front, the first sections of either of the compound eyes will be tangential to the globular mass of the combination. As the cutting approaches the centre of the combination, the sections will eventually lie in the plane of some of the "ommatidia," which all diverge somewhat in the manner of the radii of a sphere, and these may be called radial sections. The term ommatidium, or little eye, is the name given to each entire slender column, with its component parts of lenses, pigment, nerve-fibres, and layers, which parts render it in reality a distinct organ of vision. The multitudes of these ommatidia, standing side by side, in some instances amounting to many thousands, combine to form the globular mass of the compound eye.

Explanation of Plate 8.

FIG. 1.—Portion of a radial section of the compound eye of Vanessa Io, L.: **h**, hairs upon the cornea; **cf**, cornea-facets; **cr**, crystalline cones; **pg**, pigment-layer; **nr**, nerve-rods; **rt**, separated layers of the retina; **sc**, sclæra; **rm**, enlarged ends of the rhabdoms in pigment; **on**, fibres of the optic nerve; **ga**, ganglion-cells; **1**, 1, **1**, 2, layers of brain, or optic nerve.

FIG. 2.—Three ommatidia, with the nerve-rods and crystalline cones slightly separated, the various portions being indicated by the same lettering as that of Fig. 1.

FIG. 3.—The exterior surface of three cornea-facets.

FIG. 4.—A longitudinal section of a crystalline cone.

FIG. 5.—A transverse section of a crystalline cone.

FIG. 6.—A transverse section through the central portion of a nerve-rod, with the central rhabdom, surrounded by six retinulæ.

The tangential sections will show the ommatidia, as these might be seen, by looking directly into the compound eye from its outer surface, and consequently, and as a general rule, especially in the central region of each slice, they will give more or less exact transverse sections of these ommatidia.

The radial sections, on the other hand, because they lie in the planes of the above-mentioned radii, and cut them longitudinally, will show the various portions of the ommatidia in their natural superimposed connection.

The outer surface of the compound eye is formed by a skin of chitine, which may be easily peeled off in continuity, and which is as transparent as glass. This surface is divided into a great number of small areas—"cornea-facets,"—each one of which is the distal end of an ommatidium, and is itself outwardly convex. These facets have their junctures strengthened by a rim of chitine, and their contour is that of a more or less regular hexagon, with rounded corners. But this contour is not nearly so constant and regular, over the whole compound eye, as it was usually thought to be. At the juncture of three or four facets the rim often supports stiff hairs or bristles.

From the periphery of the transparent cornea the chitine skin lined within by a pigmented layer, resembling a chorioid coat, encloses the whole remaining globular mass of the compound eye, embedded in the head, and appears to correspond with the sclæra, or sclerotic of the ball of the eye of vertebrates.

Next below the cornea follow in a layer the lenses, or "crystalline cones" of the ommatidia. These cones are embedded in pigmentous cells, which separate them respectively from their neighbors. The evolution of these crystalline cones from four cells is readily to be understood. We see in their transverse section four nuclei, with distinct septa in the form of a cross.

Below the crystalline cones lies a thick layer, comprising the greater part of the bulk of the globular mass, and consisting of the "nerve-rods." These nerve-rods occupy the greater portion of the length of the ommatidia, and are respectively composed of a central fibre, which has been named the "rhabdom," surrounded by five to seven other delicate fibres, which are the retinulæ.

The rhabdom is of extreme tenuity in proportion to its length. It extends through the entire nerve-rod, from the crystalline

cone inwardly, until it ends in a spindle-shaped enlargement, embedded in the pigmented retina. In this enlarged end the rhabdom shows its nucleus.

Close to the retina follows the above-mentioned sclæra, or capsule of the whole compound eye, through which pass the fibres of the optic nerve in bundles. Here the fibres cross each other, and develop into a distinct layer, containing many ganglion-cells. They then pass into another more striped layer, forming the ganglion of the eye, and so finally over into the brain.

Tracheæ, dissolved into the finest bundles of tubes, surround the ommatidia, passing up inside of the sclæra.

POLYPORUS SANGUINEUS.

BY P. H. DUDLEY, C. E.

(Presented in connection with the specimen from Panama, exhibited by him, March 18th, 1887.)

This beautiful Polyporus, of cream colored cup, occasionally tinged with pink, and having scarlet pores underneath, attracts attention by its varied and brilliant colors. I have only seen it growing, upon the Isthmus, first, upon Cyprus ties, from Florida, where it is said to be common ; second, upon the sap-wood of the Lignum-vitæ ties, in the tracks of the Panama railroad. The fact of finding it growing upon these two kinds of woods was surprising and interesting ; for the structure and cell-contents of these two woods are so dissimilar, that I did not expect to find the same species of fungus growing upon both woods. It shows that the mycelium of the fungus is able to sufficiently disorganize each of the woods, as specified, for the growth of its fruit. I found more specimens on the Cyprus, than on the Lignum-vitæ ties, probably because the latter are so durable, as the heart-wood lasts from twenty to twenty-five years in the track ; while the Cyprus only lasts from two to three years. Lignum-vitæ is the only wood, in its natural state, when used for ties, that is able to resist decay for any length of time on the Isthmus. Many of the native woods decay in less than a year.

Near the Atlantic coast but one specimen of *Polyporus sanguineus* was found, and this was upon a Cyprus tie, in the Aspinwall freight-yard. *Trametes pini*, Fr. and *Lenzites abietina*, Fr.

were abundant upon other Cyprus ties in this yard. This wood is not used for ties in the main line of the Panama railroad. Lignum-vitæ ties, near the Atlantic coast, had been in service many years ; yet only a little fungus was found upon them.

A few specimens of *Lenzites striata*, as identified by Prof. Charles H. Peck, were obtained. At Bujio Quarry, sixteen miles inland, this latter fungus was very abundant on the sap-wood of the Lignum-vitæ ties. At Frijoles, three miles further inland, I found the same fungus, and also *Polyporus sanguineus*, on Lignum-vitæ ties, in a recently constructed switch-track. In many cases, both species were found upon opposite sides of the same tie. The *Lenzites striata* was dry and firm, and had evidently ceased growing, shortly after the beginning of the dry season. *Polyporus sanguineus*, on the contrary, was fresh and growing. At Paraiso, on the Pacific slope, this fungus was found, in conjunction with *Lenzites abietina*, Fr., on Cyprus ties, in the temporary track of the Panama Canal, and also on ties piled three and four feet high.

These specimens of fungi were collected in January and February, of the present year, during what is called there, "the dry season," which commences in December, and lasts until April or May. The remaining months are called "the wet season;" the rain-fall on the Atlantic coast being from ten to twelve feet per annum, which decreases to one-half this amount on the Pacific coast. The mean annual temperature of about 80° Fahr., and the humidity of the air, form the most favorable conditions for the growth of fungi, and consequent rapid decay of woods, on the Isthmus of Panama.

CHAMÆCYPARIS SPHÆROIDEA, SPACH; WHITE CEDAR. AND ITS FUNGUS, AGARICUS CAMPANELLA, BATSCH.

BY P. H. DUDLEY.

(*Read January 7th*, 1887.)

This is the White Cedar of the Atlantic coast, which grows in dense masses in cold, deep swamps, "from Southern Maine to Northern Florida, and along the Gulf coast to the valley of the

Pearl river, Mississippi." According to Prof. C. S. Sargent, in Tenth Census Report.

In many respects it is an exceptional tree, and one of great economical value, growing from seventy to ninety feet in height, and two to four feet in diameter; the latter is not common.

In the North especially it is a slow grower, the annular layers being narrow, from $\frac{1}{32}$ to $\frac{1}{16}$ of an inch in thickness, and as seen in the photomicrograph, Fig. I., the tracheids are small, thin walled, the wood being classed as soft and fine grained.

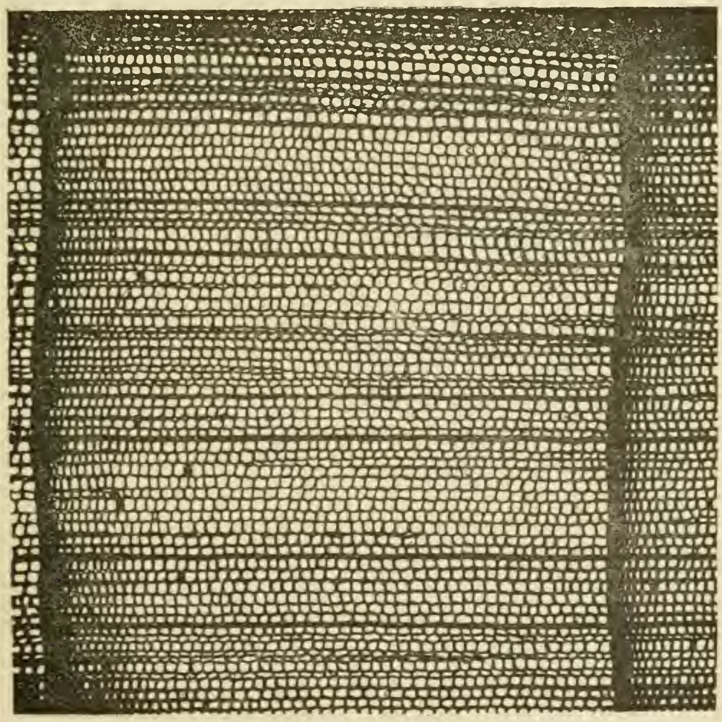


FIG. I. WHITE CEDAR. TRANSVERSE SECTION MAGNIFIED 50 DIAMETERS.

Its specific gravity ranges from 0.29 to 0.45, the latter being uncommon, 0.30 to 0.35 being the general range of the wood from the North. It is one of the group of the light coniferous woods. Sequoia gigantea, Decsn, Big Tree, Thuya occidentalis, Arbor vitæ, are as a rule 0.01 or 0.02 lower in specific gravity.

The durability of White Cedar in situations where it is alternately wet and dry or in contact with the ground, is in strong contrast to many other woods of much harder and firmer texture, and for this reason it is so largely used in ship building, for telegraph poles, fence posts and railway ties. The decay of this wood is so slow that when used for railway ties, the rails crush the fibres under them before the ties decay in the ballast, and are removed more on account of mechanical destruction than decay—as a rule.

The photomicrograph of the transverse section, Fig. I., indicates at once, by the nearly uniform thickness of the cell walls for the entire annular layer, that it is not a strong wood, as only a few rows of cells in the last of the season's growth are tabular and thickened, this is in strong contrast to the number of rows in a layer of Yellow Pine, *Pinus palustris* (Mill).

The tracheids in White Cedar are comparatively small in diameter, only ranging from 0.0013 to 0.0015 of an inch, while the lumen is from 0.0011 to 0.0013 of an inch, showing that the walls are very thin, which fact to a great extent accounts for the low specific gravity and softness of the wood.

Another feature to be noticed in Fig. I. is the comparatively small number of bands of medullary rays, showing as dark lines, crossing the (Fig.) page. The bands are only of single width of cells, and the latter so small that the lumen does not show in a magnification of 50 diameters. In a tangential section, the bands are seen to be composed of only 2, 3, 4, 6 or 8 superimposed cells, the first three predominating. In a square inch of wood only about 400 of these bands occur, a comparatively small number, and these do not furnish much resistance to indentation, but are very effectual in checking the tendency of decay, from spreading laterally.

Another feature shown by the transverse section is the absence of resin ducts, common to many of the other coniferous woods. Much of the resin is confined to special resin cells, the ends of which appear as dark cells in the photomicrograph. This feature is common to the most durable of the coniferous woods. The medullary rays of the duramen especially, also contain deposits of resinous matter, which in most cases remains intact after the surrounding tissue is well advanced in decay.

Beside the visible resinous matter in the cells mentioned, tests indicate that in the duramen there is resinous matter on and in the walls of the ordinary tracheids. They do not absorb or imbibe water readily or in sufficient quantities to cause the wood to become "water-logged" after being submerged many years.

The delicate middle lamellæ can be traced in the lenticular markings so there is not a free and unbroken communication between the tracheids, water being prevented from passing freely from cell to cell.

The thinness of the cell walls in this wood gives a greater percentage of weight, of the middle lamellæ, to the whole weight than in some other woods, and this may help account for a portion of its non-absorbing properties.

The physical properties of the tracheids as regards strength are not proportionally as great according to their specific gravity as those of many others of the coniferous woods, it having but few of the fibres per layer which contribute most of the strength and elasticity to a wood.

This is well shown in the following table :—

Name of wood.	Specific gravity.	Crushing strength in pounds per sq. inch.	Ratio.
White Cedar,	0.3429.	3697.	10781.
Yellow Pine,	0.7229.	9081.	12564.
Hemlock,	0.4240.	5549.	13086.
Tamarack,	0.6197.	8297.	13888.
Larix occidentalis,	0.6420.	9991.	15563.

The data were compiled from a series of tests upon woods made upon the U. S. Testing Machine at the Watertown Arsenal. The specific gravities and crushing strengths are the average of 4 to 8 specimens of each wood.

The ratio means the number of pounds per square inch required to crush the wood, provided the specific gravity was 1. The specific gravity of pure cellulose has not been determined, but is estimated to be from 1.25 to 1.45. The relatively low crushing resistance of the white cedar, according to its specific gravity, is very marked, in comparison with the other woods given in the table, and has given rise to the hypothesis, that there is a difference in the chemical composition between the thick and the thin walled tracheids. I had a series of chemical analyses made to determine the matter if possible. A slight differ-

ence was found, but neither series gave satisfactory formulas for cellulose, so the matter is still unsettled.

Under the microscope, it seems to be the second lamellæ of the tracheid, which is principally increased, in the thick walled tracheids; and woods which do not have a portion of the annular layer composed of the thick walled tracheids, do not have as high specific gravity, or as much strength.

THE FUNGUS AGARICUS CAMPANELLA, BATSCH.

Pileus only three-eighths to one-half inch broad. The mycelium is composed of very coarse dark threads. The numerous decayed spots, from one-fourth to one inch in diameter extending longitudinally in the wood, found in many of the railroad ties cut from live White Cedar trees, are exceptional, rarely being found in other woods. How the decayed spots are started and checked, for the time being, forms one of the many interesting questions in the decay of woods.

The young tree sends out an abundance of limbs near the base and as the tree increases in height, the lower limbs become shaded then die, and being so durable, do not quickly break off close to the body of the tree, the latter soon forming a layer of wood over the wound. The moisture which collects at the junction of the limb and tree, germinates the spores of its special fungus, and starts the growth of a mycelium inducing a decay in the upright cells, spreading laterally but little. This continues until the growing wood closes up the orifice, by shutting off the air supply, and further decay is arrested.

In case the sapwood does not close the orifice, the decay continues, the result being a hollow tree.

PROCEEDINGS.

Meeting of May 6th, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Twenty-five persons present.

The Corresponding Secretary read a letter from Dr. Henri Van Heurck, of Antwerp, Belgium, expressing thanks for his election to Honorary Membership in this Society.

The Corresponding Secretary also acknowledged the receipt of copies of Dr. Van Heurck's Communications to Scientific Societies at Antwerp.

The Librarian, Mr. A. Woodward, read a letter from Mr. G. S. Woolman, who presented to the Society a copy of the new work by Dr. Alfred C. Stokes, entitled, "Microscopy for Beginners."

Mr. A. Woodward also read a Paper, entitled, "The Foraminiferal Fauna of the Miocene Bed at Petersburg, Va.," which Paper is published in this volume of this Journal, at page 16.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

1. *Meyenia fluviatilis, var. asperrima*, Dawson, from Calumet River: exhibited and described by A. Woodward.

Fresh-water sponge. Spicules birotulate, that is, consisting of two wheels or disks, connected at their centres by a short shaft, or they may be flat or umbonate disks.

"The first sponge found in Niagara River by Prof. Kellicott, belongs to this genus. Mr. G. M. Dawson had found the same species in Canada, and named it *Spongilla asperrima*, but according to our present classification it must be *Meyenia asperrima*. It differs very slightly, if at all, from *Meyenia fluviatilis*."

2. *Spongilla fragilis*, Central Park, New York City. A dried specimen: exhibited and explained by A. Woodward.

3. Specimens of *Amphistegina lessonii*, d'Orb., from Petersburg, Va. Also others from Nussdorf, near Vienna, Austria: exhibited and explained by A. Woodward.

4. *Laminaria longicruris*, Dela, Portland Harbor, Me. Broken up and distributed to the members: exhibited and explained by A. Woodward.

5. Section of Concord Granite (under the Polariscope): exhibited by T. B. Briggs.

6. Bryozoa: exhibited and described by W. E. Damon.

This specimen shows the delicate lace-like structure of the corallaceous deposit of this compound polyp animal; formed on the inside of the neck of a bottle—hence the honey-comb like cells have been well protected, and are very perfect.

7. Eggs of Bot-Fly (*Gasterophilus equi*) on horse hairs, with the larvæ emerging: exhibited by Chas. S. Shultz.

The larvæ of this species live in the intestines of horses, producing the disease called Bots (Harris).

The female fly has a long and flexible *ovipositor*, with which she deposits her eggs upon the hairs of the fore legs of the horse, while sustaining herself in the air by reduced motion of the wings. The eggs are covered with glutinous matter causing them to adhere to the hairs, and few are deposited out of the reach of the mouth of the horse.

8. Head of the Mosquito, with lancets. Showing five minute stings (?), two of them barbed: exhibited by CHAS. S. SHULTZ.

9. Snail's Eggs. Young snail, within egg; polarized: exhibited and explained by F. W. DEVOE.

10. Egg shells of the *Vanessa Antiopa*, Linn.: exhibited by E. B. GROVE.

The Eggs of the *Vanessa* differ from those of other Lepidopterous insects, in having a much harder shell.

MEETING OF MAY 20TH, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Seventeen persons present.

The President announced the receipt of various Publications, in exchange for the Journal of the Society.

Messrs. James Walker and T. B. Briggs were elected Resident Members of the Society.

The President presented to the Cabinet of the Society the slide exhibited by him, displaying the three main sections—transverse, radial and tangential—of the wood of the Black Mangrove.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

1. Quill of Canada Porcupine (*Erethizon dorsatus*): exhibited and described by B. BRAMAN.

"The quills of the Canada Porcupine are from one inch to three inches long. They are loosely attached to the skin, and are barbed at the point. They easily penetrate the flesh of the animal which attacks it, strongly retain their hold, and tend continually to become more deeply inserted."

2. Consecutive Sections through Head of *Salamandra maculosa* (larva); exhibited and described by L. RIEDERER.

The eye shows all the constituent parts as : cornea, iris, lens, sclerotic, choroid, vitreous humor, retina, nerve granules and fibers, rods and cones, and entrance of optic nerve (blind spot).

3. Black Mangrove (*Avicennia nitida*, *Jacq.*), transverse section of wood of : exhibited and described by J. L. Zabriskie.

This tree is a native of the West Indies, and also of the Florida coast. The wood is heavy, hard, coarse-grained, and of dark brown color. The transverse section shows the very eccentric manner of growth of the annual rings, the irregular position of the large ducts, and the abundance of resinous material.

4. Head of a Bishop's Mitre, one of the *Asopidae :* exhibited and described by F. W. Leggett.

This relative of the "Cimex" is a great nuisance to fruit growers, not only sucking the juice of fruit, but rendering it unpalatable because of a fluid possessing an abominable smell, which exudes from two little pores between the hind feet. The compound eyes, the two red ocelli, the antennæ and the rostrum, within which are the toothed lances, can be plainly seen.

OBJECTS FROM THE SOCIETY'S CABINET.

5. Trans. sec. of the False Truffle (*Melanogaster ambiguus*, Tul.), showing the spores in situ ; collected at Poughkeepsie, N. Y, and prepared by W. R. Gerard ; × 250.

This fungus (see Species No. 1,048, Cooke's Hand-Book Brit. Fung.) is subterraneous, but it is more closely related to the Puff-Balls than to the genuine Truffle. Species of the latter have their spores situated in sacks, while *Melanogaster* has the spores diffused in patches throughout the pulpy, dark, globose *hymenium*. And this species is distinguished by its large, ovate, papillate spores, "and its abominable smell, which resembles that of assafœtida. A single specimen in a room is so strong as to make it scarcely inhabitable."

6. Scale of Common Sun-fish (*Lepomis gibbosus*) ; by polarized light ; × 30.

This scale strikingly exhibits the characteristics of the Perch family ; the rows of sharp, alternating spines, projecting from the posterior free margin, and the prominent radiating rows of transverse ridges, extending to the anterior margin, which is imbedded in the skin.

7. Hairs of Edelweiss : the famous Alpine plant, nearly exterminated for the gratification of tourists.

8. *Polycystina* from Barbadoes ; × 30 ; very neatly arranged in a symmetrical pattern.

Meeting of June 3d, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Twenty-four persons present.

In the absence of the Recording Secretary, Mr. Geo. E. Ashby was appointed Secretary *pro tem.*

The Corresponding Secretary read a communication from the Royal Danish Academy of Sciences, at Copenhagen, expressing thanks for the presentation of copies of the Journal of this Society.

Mr. Wilson Macdonald was elected a Resident Member of the Society.

Mr. L. Riederer read a Paper, in continuation of his remarks at the last meeting, on the Head of *Salamandra maculosa*, illustrated by a large and finely executed diagram, and by many excellent consecutive sections under the microscope, as set forth in the exhibits of this meeting.

Mr. F. W. Leggett read a Paper describing his exhibit, referring especially to the ability of the Roach to walk. when inverted, and suspended on the under surface of a horizontal sheet of glass.

He arrived at the conclusion that the tarsal joints were cup-shaped, and of peculiar construction, and that the insect attached its feet by suction.

OBJECTS EXHIBITED.

1. *Salamandra maculosa ;* sections through the head ; showing constituents of tissues of skin, skull with brain, the eyes, the ciliated membranes in cavity of mouth, the tongue, ducts to gills, &c.

2. Pulvillus and ungues of Roach (Blatta) : by F. W. Leggett.

3. Pulvilli on tarsal joints of Roach (Blatta) : by F. W. Leggett.

4. Sections of Felspar, perpendicular to, and parallel with the lines of cleavage : by T. B. Briggs.

5. Wood of the Maple (Acer), with the structure much broken down by decay, but beautifully showing the plates of the medullary rays, and certain of the hard longitudinal cells ; by reflected light : by M. M. Le Brun.

OBJECTS FROM THE SOCIETY'S CABINET.

6. Pyrite, showing free Gold, Grass Valley, California.
7. Diatoms, from Santa Monica, California.
8. *Isthmia nervosa*, on Algae, Monterey, California.
9. Spicules of Sponge, from California.
10. Sherzolite, from the French Pyrenees.
11. Volcanic Glass, from the Sandwich Islands.
12. Quartz, from inclosure in Muscovite, Grafton, N. H.
13. Quartzite, from the Black Hills.

Mr. C. E. Hanaman, F. R. M. S., Curator of the American Postal Microscopical Club, being present as a visitor, on request, addressed the Society, giving information concerning the operations of the Club.

Meeting of June 17th, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Twenty persons present.

Mr. C. S. Shultz remarked upon the Stage Micrometer exhibited by him, and ruled by Prof. Wm. A. Rogers, dwelling particularly upon the numerous difficulties met in operations of this kind.

Mr. P. H. Dudley followed with further particulars respecting the Dividing Engine employed by Prof. Rogers, and the mode of correcting errors in its practical working : also respecting the comparative advantages and disadvantages of rulings on glass and metal. In explanation of his own exhibit—the Fasoldt Eye-piece Micrometer—he said, that the lines were exceedingly delicate, and spaced at a distance of 500 to the inch.

Mr. E. B. Grove, in connection with the exhibit by Mr. F. W. Leggett, maintained, regarding the motion of the ovipositor of the Saw-flies, that their action was not direct, but with a twisting

thrust, and that these cutting instruments might be more appropriately termed rasps than saws.

Mr. C. S. Shultz presented to the Cabinet of the Society two slides of Diatoms, prepared by Miss M. A. Booth.

This being the last meeting before the summer recess, the President wished for the members a pleasant vacation, and a safe return to the operations of the Society, and urged upon them the duty and advantage of the prompt commission to writing, and the preservation of some notes of their microscopical vacation experiences.

OBJECTS EXHIBITED.

1. Stage Micrometer—in squares—upon Speculum metal: exhibited by CHAS. S. SHULTZ.

This was ruled by Prof. Wm. A. Rogers, upon his dividing engine, in two sections; in one the divisions are parts of an inch, in the other, parts of a millimeter. Much longer ruled micrometers on metal, of which the error of the ruling of each division has been fully investigated, are now used as the standards of measure for the accurate construction of tools and machine work.

These measures are placed upon instruments known as Comparators, each of which has two reading microscopes with eyepiece cobweb micrometers. The objectives are provided with a Tolles' vertical illuminator, so the divisions on the micrometer appear very black. The system is so practical that mechanicians are able to work within an error of $\frac{1}{50000}$ of an inch.

2. *Triceratium Javanicum*: exhibited by CHAS. S. SHULTZ.

3. Section from Scalp of White Collared Monkey: exhibited by CHAS. S. SHULTZ.

4. Albany City Water: exhibited by P. H. DUDLEY.

5. Eye-piece micrometer, made by Mr. Chas. Fasoldt: exhibited by P. H. DUDLEY.

The lines are said to be ground in the glass, not ruled.

6. Spores of *Merulius lachrymans*, Fr., from Hartford, Ct.: exhibited by P. H. DUDLEY.

This fungus is the one which often causes the so-called "dry rot" of houses, especially those of pine wood. It is commonly in the form of a placenta, but also effuso-reflexed. The forms are from two inches to thirty in diameter. The hymenium is pulverulent, and throws off great numbers of spores—those thrown

off from one form, about 20 by 30 inches in area, from which these are part, were sufficient to give a decided ferruginous shade to 350 square feet of flooring.

7. Cuticle of *Cyperus umbellatus*: exhibited by M. M. Le Brun.

8. Ovipositor of a Saw-fly: exhibited by F. W. Leggett.

9. Section of Limestone; polarized: exhibited by T. B. Briggs.

EXHIBITS FROM THE SOCIETY'S CABINET.

10. Section of Petiole and Leaf of the White Water Lily.
11. Section of Leopard Skin.
12. Scales of *Telea Polyphemus*.
13. *Zea Mays*: Portion of Leaf.
14. *Deutzia gracilis*: Portion of Leaf.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

MEETING OF JUNE 22D, 1887.

The regular semi-monthly meeting of the San Francisco Microscopical Society was held last evening at its rooms, President Wickson occupying the chair.

Series 2 and 3 of Walker & Chase's "New and Rare Diatoms," consisting of photo-engravings of interesting forms, with descriptive text, were donated by Dr. H. H. Chase.

A communication was received from A. J. Doherty, of Manchester, England, the well-known preparer of microscopic objects, announcing his intention of visiting this city in a few months. Arrangements have been made with him for a series of demonstrations of the most approved methods used in the preparing and mounting of objects for the microscope, and from the admitted ability of the gentleman in this line his discourses cannot fail to be interesting and instructive. A series of slides mounted by him and comprising a wide range of subjects, were shown under a number of microscopes last evening by J. G. Clark, and the excellence of workmanship shown by these mounts, elicited the warmest commendation.

J. A. Sladky, of Berkeley, was duly elected a resident member.

The useful little device known as "Griffith's Focus Indicator," was shown by Mr. Riedy. Its object is to enable an approxi-

mate focus to be obtained almost instantly, and to prevent the accidental crushing of a slide or cover-glass by the objective, in focusing.

Mr. Norris announced that through the kindness of Mrs. Ashburner, he had come into the possession of a number of exquisite slides, mounted by the late Prof. Ashburner, and comprising a number of preparations of the celebrated "original Santa Monica" find. No better disposition could be made of these, Mr. Norris thought, than to distribute them among the members of the society, and this he proceeded to do. As appropriate mementoes of a departed friend, as evidences of his rare skill as a microscopist, and as the last remaining examples of mounts from the remarkable fragment whose history has been so closely connected with that of the society, these slides will be considered treasures by their fortunate possessors.

Specimens of rich diatomaceous earths from near San Pedro, and from near Santa Monica, collected by Mrs. Bush, of San José, were also handed in by Mr. Norris.

A. H. Breckenfeld, *Recording Secretary.*

EDITORIAL.

Although not sufficiently acquainted with the difficult, and at present much examined and much disputed subject of the compound eye, to be able to endorse all the interpretations of Mr. Riederer, in his article in this number of this Journal, we nevertheless take great pleasure in stating that his sections of the compound eye of Vanessa Io—sixty-eight sections on four slides —,exhibited before the Society, were skilfully cut and beautifully stained and mounted.

The illustrations of his article were drawn by means of the prism, directly from his slides, and, it is hoped, give a moderately fair representation of what was there seen.

They who are acquainted with the nature of the compound eye, will understand that the parts are, in life, all in juxtaposition. And the divisions between cornea-facets and crystalline cones, between the sclæra and the nerve-rods, and between the separated layers of the retina, shown in the preparations, are occasioned by the shrinkage, due to the methods of staining and mounting.

The following extract from an article by M. A. Forel, in Rec. Zool. Suisse, iv. (1886) pp. 1–50, published in the Journ. Royal Micros. Soc., June, 1887, p. 379, will be of interest, in connection with the article by Mr. Riederer, in this number of this Journal.

Vision of Insects.—M. A. Forel gives an account of past and recent experiments on the vision of insects, and sums up the conclusions as follows :—

(1) Insects direct themselves in flight almost wholly, and on the ground partially by means of their facetted eyes. The antennæ and buccal sensory organs cannot serve for directing flight. Their extirpation makes no difference.

(2) J. Müller's mosaic theory is alone true. The retinulæ of the compound eyes do not each receive an image, but each receives a simple ray more or less distinct in origin from that of its neighbors. Gottsche's theory is false. (Müller, Grenacher, Exner.)

(3) The greater the number of facets, the more elongated the crystalline cones, the more distinct and the longer the vision. (Müller, Exner.)

(4) Insects can see particularly well the movements of bodies, and better during flight than when at rest, the image being displaced in relation to the eye (Exner). This perception of the mobility of objects diminishes as the distance increases.

(5) Contour and form are only indistinctly appreciated, and the more indistinctly the fewer the facets, the shorter the crystallines, the farther and smaller the object. Insects with big eyes with several thousand facets can see with tolerable distinctness.

(6) In flight, insects can by means of their compound eyes appreciate with accuracy the direction and distance (not too great) of objects. When at rest they can also estimate the distance of fixed objects.

(7) Certain insects (bees and humble-bees) can clearly distinguish colors, and that better than form. In others (wasps) the perception of color is very rudimentary. Ants perceive the ultra-violet rays (Lubbock).

(8) The ocelli seem to furnish only very incomplete vision, and to be simply accessory in the insects which possess also compound eyes.

PUBLICATIONS RECEIVED.

Johns Hopkins University. Studies from the Biological Laboratory: Vol. IV., No. 1 (June, 1887); pp. 53. Circulars: Vol. VI., No. 58 (July, 1887); pp. 26.

The Microscopical Bulletin and Science News: Vol. IV., No 3 (June, 1887); pp 8.

Journal of the Royal Microscopical Society: 1887, Pt. 3 (June); pp. 176.

The School of Mines Quarterly: Vol. VIII., No. 4 (July, 1887); pp. 26 + 96.

Proceedings of the American Academy of Arts and Sciences: New Ser., Vol. XIV., Whole Ser., Vol. XXII., Pt. 1 (May to December, 1886); pp. 269.

Bulletin of the Torrey Botanical Club: Vol. XIV., Nos. 6–7 (June-July, 1887); pp. 46.

The West-American Scientist: Vol. III., Whole Nos. 25-26 (May–June, 1887); pp. 33.

National Druggist: Vol. X., Nos. 22-25 (June, 1887), Vol. XI., Nos. 1-4 (July, 1887); pp. 100.

Proceedings of the Natural Science Association of Staten Island: May–June, 1887; pp. 3.

The Electrician and Electrical Engineer: Vol. VI., No. 66 (June, 1887); pp. 40.

Grevillea: No 76 (June, 1887); pp. 48.

Le Moniteur du Pratcicien: Vol. III., Nos. 5-6 (May–June, 1887); pp. 64.

Jahresbericht der Naturhistorischen Gesellschaft zu Nurmberg: 1886; pp. 68.

Bulletin of the California Academy of Sciences: Vol. II., No. 6 (January, 1887); pp. 243.

The American Monthly Microscopical Journal: Vol. VIII., Nos. 6–7 (June-July, 1887); pp 40.

Bulletin de la Société Belge de Microscopie: Vol. XIII., No. 7 (1886–1887); pp. 26.

The Botanical Gazette: Vol. XII., Nos. 6–7 (June–July, 1887); pp. 50.

Transactions and Annual Report of the Manchester Microscopical Society, 1886; pp 36 + 91.

Monatsblätter des Wissenschaftlichen Club in Wien: Vol. VIII, No. 9 (June 15th, 1887); pp. 8. Ausserordentliche Beilage: No. 5 (March 7th, 1887); pp 19

The Hoosier Naturalist: Vol. II., No. 9 (April, 1887); pp. 16.

The Journal of the Cincinnati Society of Natural History: Vol. X., No. 2 (July, 1887); pp. 58.

Entomologica Americana: Vol. III., No. 4 (July, 1887); pp. 20.

Manitoba Historical and Scientific Society, Winnipeg. Annual Report for the year 1886–7; pp. 12 Transactions 22–29 (April, 1886–April, 1887); pp 104.

Indiana Medical Journal: Vol. V., No. 12 (June, 1887); pp. 22.

The Pacific Record of Medicine and Surgery: Vol. I., No. 11 (June 15th, 1887); pp. 32.

The Ottawa Naturalist: Vol. I., Nos. 3–4 (June–July, 1887); pp. 32.

Anthony's Photographic Bulletin: Vol. XVIII., Nos. 11–14 (June–July, 1887); pp. 128.

Journal of Mycology: Vol. III., Nos. 6–7 (June–July, 1887); pp. 24.

The Hahnemannian Monthly: Vol. XXII., Nos. 5–7 (May–July, 1887); pp. 192.

The Microscope: Vol. VII., Nos. 6–7 (June–July, 1887); pp. 64.

The Naturalist: Nos. 143-144 (June–July, 1887); pp. 64.

Transactions of the Massachusetts Horticultural Society for the year 1886, Pt. 2; pp. 187.

The Canadian Record of Science: Vol. II.. No. 7 (July, 1887); pp. 64.

The Journal of Microscopy and Natural Science: Vol. VI., Pt. 23 (July, 1887); pp. 64.

Nottingham Naturalists' Society. Transactions and Thirty-fourth Annual Report, 1886; pp. 76.

Penzance Natural History and Antiquarian Society. Report and Transactions, 1886–87; pp. 84.

Bulletin de l' Académie d' Hippone No. 22 (1887), Fasc. 1; pp. 176.

Biological Instruction in Universities; pp. 13. By C. O. Whitman.

Bulletin of the American Museum of Natural History: Vol. II., No. 1 (May, 1887); pp. 39.

Smithsonian Institution. Annual Report of the Board of Regents to July, 1885, Pt. 1; pp. 996.

FUR FIBRES.

JOURNAL

OF THE

NEW-YORK MICROSCOPICAL SOCIETY.

VOL. III. OCTOBER, 1887. No. 4.

FUR FIBRES

BY H. L. BREVOORT.

(*Received Sept. 26th*, 1887.)

Plate 9.

In the Journal of the Society, Vol. II, No. 5, some notes appeared relating to the structure of the fur fibre.

These observations related more especially to what the writer knew about the subject, rather than to that which he did not know. As a matter of fact the latter field is so much larger than the former, that a few words in relation thereto may set others working in a field, believed to be rich in results of a commercial nature.

The fur of animals now so largely enters into manufactures, that the question of its exact structure and mode of growth becomes one of commercial importance. The writer has penetrated this field, it is believed, as far and further perhaps than anyone else, but that which has been observed amounts to so little, and that which has not been observed amounts to so much, that to the latter field the writer feels that he may invite other workers, confident that they will find a rich reward for their labors.

In the accompanying illustrations, the plate in front shows views of the fur of the Scotch Grey Coney, or Rabbit. The fur of this animal is largely used in the manufacture of hats.

The fibre is enlarged one thousand diameters. Its length on this scale would be some eighty or ninety feet, consequently only portions of its length have been shown. The view on the left of the figure showing a tuft of dirt at its top or where it

emerges from the skin is that portion of the fibre immediately adjacent to the skin. This portion in almost all animals bearing fur (some water animals excepted) is smooth, perfectly transparent, and the writer has never, by any method known to him, been able to find any tube or duct therein. The portion next on the right in the plate shows the fibre having pronounced scales or projections, and is a representation of the fibre at a short distance from the skin, say at a point about one-sixth or one-eighth of its length.

GRAY CONEY
Fig. 1.

The next portion towards the right in the plate shows the center or middle portion of the fibre, and the part on the right next adjacent shows the fibre at some three-quarters of its length. The extreme right hand portion represents the point of the fibre.

Thus it will be seen that the fibre starts from the skin, small in diameter and smooth as to external appearances, that next it enlarges and shows pronounced external scales or projections, and that then at and about the center the maximum diameter is reached ; the scales are large but do not project much, and towards the point or outer end of the fibre the diameter decreases and a marked decrease in the size of the scales is also observed.

The attention of the reader is now invited to Fig. 1.

This shows the center lengthwise of a fibre of the kind of fur illustrated in the plate, after it has been soaked in glycerine for a short time to make it transparent.

It will now be seen that air cells, separated by pigment cells, alternate ; the dark bands representing the pigment cells, and the intermediate light portions the air cells.

After prolonged soaking in glycerine, these dark bands of pigment cells separate, and individual pigment cells drop into the air cells, showing that each dark band is composed of many minor cells closely compacted.

The pigment cells are supposed to contain that greasy or water repellant material, which exudes from under the scales, and which keeps the exterior of all fur fibres in an anointed

condition, enabling the animal, so protected, to resist moisture by reason of the grease (or whatever it is) having a disinclination to permit moisture to remain upon the fur of the animal.

Now the first question to be solved by some observers is this. How do fur fibres grow? It is ridiculous to think that they are projected from the skin of the animal point first in a completed condition.

This view appears to be answered by the scales themselves, which would prevent any such growth. If this is not so, how do the pigment cells find their way through the ductless portion adjacent to the skin, or butt end of the fibre, to the points between the air cells? In fact the question presented is, how does a fur fibre grow? The writer has never been able to solve this problem. Some worker with the microscope is invited to take up this question and find its solution.

The next question to be answered is this. Do the scales themselves by their union at their butts, or inner ends, form the wall of the fibre; or do the scales grow out from a separate and distinct wall of substance, forming a tube as it were around the air and pigment cells, and inside of the roots or inner ends of the outer scales? The writer has never been able to solve this problem.

It cannot be doubted that the pigment cells find their way to the exterior of the fibre, emerging from under the scales. The question here presented is: How, or through what channels do they find their way, from the interior to the exterior of the fibre?

While referring to the pigment cells this question is presented: Are the pigment cells massed in a solid disc across the central tube of the fibre; or are they merely a lining, surrounding an opening through the fibre? Do they oppose themselves as a barrier to the passage of other pigment cells; or do they merely form a ring, at approximately equi-distant portions of the fibre's length? The great difficulty of cutting sections in any direction of a fur fibre has prevented further light on these interesting points from being obtained.

Somewhat imperfect sections have been made, and they go to show that each fibre is oval; and it would appear that a clear passage existed through the mass of pigment cells, but such observations have been altogether too uncertain to allow of any definite answer being given to the questions here asked.

Fur fibres appear to grow in groups, that is, from a pocket in the skin. A number of fibres are projected (usually an uneven number, seven, nine, eleven or thirteen) from each pocket, and the individual fibres do not appear to possess the mechanism for growth, common in the case of a human hair.

How they grow is yet a mystery. Do new fibres project themselves each year? Do the animals that change color between Summer and Winter get a new growth of fur, or is the old fur in the wet season charged with new pigment cells, and in the dry season deprived of pigment cells? In the first place, the wet season would call for a more thorough greasing of the fibres, so that the water could be easily shed; while in the second case there would not exist this necessity, but to resist dry cold, the maximum air space would be required in each fibre, and then the pigment cells could be discarded to advantage, for the purpose of obtaining an enlarged air space in each fibre.

No one worker with the microscope can hope to answer these questions. The answer must be found in the observations made by widely separated students, who each have an opportunity to observe fur bearing animals under different climatic conditions.

The writer having accomplished the practical results he desired by his observations, and with the assistance of others, the interesting scientific questions referred to must be left to those, whose devotion to the microscope will induce them day after day to work with powers not below ⅛, and who are willing to search long and faithfully to find out some of nature's secrets, the discovery of which may not repay the students in other coin than the satisfaction of an increased knowledge, but which probably may come back to them in the shape of a substantial recompense for their time and labor.

Many other questions could be asked, but if the writer is not mistaken, to give correct answers to these propounded, with the proof of their correctness, will require a great deal of study and observation.

NOTES ON THE ROACH (BLATTA ORIENTALIS, L.).

BY F. W. LEGGETT.

(*Read June 3d*, 1887.)

1. Respiration.

Under the first microscope I have a living specimen, and under the other the stigmata and tracheæ of the *Blatta orientalis.* This aristocratic insect can boast a pure lineage reaching back to, if not beyond the coal measures.

The part to which I desire to call attention is the breathing process. Of this Huxley says, "There are ten stigmata on each side of the body, eight in the abdomen and two in the thorax. The latter are situated between the prothorax and the mesothorax, the mesothorax and the metathorax respectively, above the attachment of the coxæ, and beneath the terga. The abdominal stigmata lie in the soft integument which connects the sterna and terga of the somites. All the stigmata are situated in conical thickened elevations of the integument. The thoracic stigma are the largest, and the anterior pair have a distinctly two-lipped aperture, the anterior lip being notched in the centre. The openings of the abdominal stigmata are more oval, and are inclined backward. Immediately within each stigma the tracheal trunk into which it opens is provided with a valvular arrangement, by which the passage can be closed or opened. The large tracheæ which take their origin from these stigmata immediately divide and give off dorsal and ventral branches ; the former unite in a series of arches on each side of the heart, while, on the ventral side, the branches are connected by trunks which run parallel with the abdominal ganglia."

Huxley is less explicit in his description of the breathing apparatus, than of other parts of the Roach, and fails to notice the bellows-like motion of the upper and lower shell of the animal. That this takes place, will, I think, be apparent to anyone looking at the living specimen under the microscope. And the question suggests itself—Is not this the process by which the creature draws in the air, and forces it through the entire system of the tracheæ ? And again, does this air find inlet and outlet at the same place, or does it enter at the thoracic spiracles, to be expelled through the abdominal stigmata ? Answers

to these questions become of some importance as suggesting a possible means of exterminating these pests. My own experiments indicate that they require a large amount of air and that insect powder, sprinkled upon them causes speedy destruction from suffocation.

In the living Roach, when placed in a proper position, the stigmata are plainly apparent; but when dead, it requires dissection to discover them. The cerci do not appear to be connected with vital functions, and can be eliminated without apparent discomfort, for I have two, in happy captivity, with these appendages removed.

These creatures possess highly organized sensory apparatus. They scratch their bodies against projections, as one sees swine rubbing their sides against the pen.

There appear to be at least three varieties of Roach in this city; the so called croton bug, also a creature three times the size of this last, and finally the common Roach. All are similar in construction, but they have different habits. The Roach proper hates the light, while the others although preferring darkness, are quite active in daylight, and are free from the disgusting Roach odor. Another peculiarity I have to complain of is the difficulty of procuring specimens when wanted. An offer of five cents a head has procured me only a limited supply, although I have been assured that, when a price was not set, they held regular camp-meetings, and could be obtained by the hundreds! This last fact suggests that their hearing must be remarkably acute!

2. Action of the Pulvilli.

While looking at some Roaches confined in a glass-covered box, I saw a large female walk across the glass, body downward. Her movements being deliberate I noted the following facts. She placed the pulvillus, which is situated at the extreme point of the tarsus, and between the ungues, against the glass, pressing it firmly until it adhered, and then bent all the tarsal joints until their pulvilli, which surmount each joint, came in contact with the glass and became attached. The foot by this process was so firmly fastened that it required considerable effort to dislodge it, prior to its use for another step. It was loosened however by releasing first the pulvillus of the toe, and then the pulvilli of the other joints in succession.

Being interested in these movements I amputated a great many legs, looked at them in a variety of ways, and became convinced that the means of attachment was exhaustion of air. Finding no authority on this subject, I have some hesitation in giving my own conclusions, but do so in the hope that, if I am in error, some member, better informed than myself, will correct me. It seems to me that the pulvillus between the ungues is bell-shaped, but has a rounded, or cushioned cover, which is tightly shut when suction is not required. The pulvilli at the extremity of each tarsal joint have each a like cover, which is withdrawn, disclosing triangular lips, which are pressed against the glass, when attachment is desired.

All the Blatta do not have these organs equally developed. For this female is the only one I have caught in the act of walking head downward. While of a dozen I had in a bottle only two succeeded in climbing to its mouth, and resting on its mosquito-net covering.

THE HEAD OF SALAMANDRA MACULOSA.

BY LUDWIG RIEDERER.

(*Read June 3d*, 1887.)

The consecutive sections of the Head of Salamandra maculosa, larva, were received so favorably at our last meeting that I was desired to exhibit them at another time, and to give a more explicit description. For this purpose I have prepared these enlarged diagrams.

The amphibia show under the microscope, more advantageously and more distinctly than any other class of animals, the final constituents of the tissues, such as cells, their nuclei, and the fibres and fibrils of the muscles and nerves. While in the process of development the exhibition of these tissues is more instructive than in the condition of their maturity.

To give first a general survey of the diagram, we see the skin enclosing the whole, the skull, with the brain central in the upper part, the eyes on both sides of the skull, the cavity of the mouth, the tongue, and the conduits leading to the openings of the gills.

The skin is formed by a single layer of cells. The skull is a capsule formed by a cartilaginous substance of varying thickness, which in course of development ossifies. Only at a few places is it perforated for the passage of nerves, blood-vessels and spinal marrow. The enclosed brain shows the bilateral, symmetrical form, and the white and gray substance—this latter with large ganglion cells, and their nuclei.

The eyes are enclosed by a hard skin, the *sclerotica*, which in front becomes thinner and transparent, forming the cornea. In our object the skin over the cornea is not yet perforated. The eye in the larval state is still internal, and consequently the animal is either blind, or at least not sharp-sighted. The *chorioidea*, a layer of pigmented cells, lines the inside of the *sclerotica*, leaving the iris, as a perforation in the front part of the eye. In this perforation, framed like a window, lies the spherical lens.

Inside of the *chorioidea* is the retina, the third layer of the eye. Between the cornea and the lens is the aqueous humor, and between the lens and the retina is the vitreous humor. This latter is of a more consistent nature than the former. Retina is a complex name for different layers, formed by the ends of the fibres of the optic nerve.

The optic nerve, coming from the cerebrum, penetrates the three layers of the eye, the sclerotic, the chorioid and the retina ; spreads on the inner surface of the latter, radially from the center to the periphery on the rear of the eye-ball ; and there forms layers of ganglion cells, internal fibres, internal nuclei, external fibres, external nuclei and rods and cones. These rods and cones lie close to the *chorioidea*.

Here is shown again the advantage of the eye of an amphibian in the larval stage for microscopical observation. The different layers of the retina are composed of large elements, and show very distinctly ; while the eye in the mature state mostly shows the retina as a thin layer, the constituent parts of which can be seen only by dissection by means of needles.

In the cavity of the mouth, the roof, as well as the surface of the tongue, is covered by a membrane of ciliated cells. In the tongue we see the cartilaginous formation of the bone, and muscle-fibres, in both longitudinal and transverse section, prov-

ing that they are running in all directions, and with these also are seen the blood-vessels.

On both sides of the tongue are the lower and upper maxillary bones, in the form of cartilage, the masseters, which raise the lower jaw for chewing, and the ducts, through which the water is led to the gill-openings for respiration.

THE NEW ARTIFICIAL RUBIES.

BY GEORGE F. KUNZ.

(*From "Transactions of the New York Academy of Sciences," October 4th,* 1886, *p.* 4.)

The subject of artificial gems is at the present moment of considerable interest, not only financially, but also as furnishing an example of the manner in which the microscope is constantly called into use by almost every profession. Early this summer, the Syndicate des Diamants et Pierres Precieuses were informed that certain stones, which had been sold as rubies from a new locality, were suspected to be of artificial origin. They were put upon the market by a Geneva house; and it was surmised that they were obtained by the fusion of large numbers of small rubies, worth at the most a few dollars a karat, into one fine gem worth from $1,000 to $2,500 a karat.

Some of these artificial stones were kindly procured for me by Messrs. Tiffany & Co. I was not, however, permitted to break them for analysis, to observe the cleavage, or to have them cut so that I could observe the optical axes more correctly. I would at any time have detected the artificial nature of this production with a mere pocket lens, as the whole structure is that peculiar to fused masses. Examination elicited the following facts: The principal distinguishing characteristic between these and the genuine stones is the presence in them of large numbers of spherical bubbles, rarely pear-shaped, sometimes containing stringy portions showing how the bubbles had moved. These bubbles all have rounded ends, and present the same appearance as those seen in glass or other fused mixtures. They are nearly always in wavy groups or cloudy masses. When examined individually they always seem to be filled with gas or air, and often form part of a cloud, the rest having the waviness of a fused

mixture. Some few were observed inclosing inner bubbles, apparently a double cavity, but empty. In natural rubies, the cavities are always angular or crystalline in outline, and are usually filled with some liquid, or, if they form part of a "feather" as it is called by the jewelers, they are often arranged with the lines of growth. Hence the difference in appearance between the cavities in the natural gem and those in the fused gem is very great, and can readily be detected by the pocket

Fig. 1.—Spherical cavities in artificial ruby as seen at one time (enlarged 75 diameters).

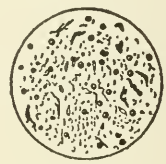


Fig. 2.—Spherical and irregular cavities in artificial ruby as seen at one time, evidently from the lower part of the crucible (enlarged 25 diameters).

lens. I have failed to find in any of the artificial stones even a trace of anything like a crystalline or angular cavity. Another distinguishing characteristic is that in many genuine rubies we find a silky structure (called "silk" by the jewelers), which, if examined under the microscope, or under a $\frac{4}{10}$ to $\frac{8}{10}$ inch objective, we find to be a series of cuneiform or acicular crystals, often iridescent, and arranged parallel with the hexagonal layers of the crystal. When in sufficient number, these acicular and arrow-shaped crystals produce the asteria or star effect, if the gem is cut *en cabochon* form with the centre of the hexagonal

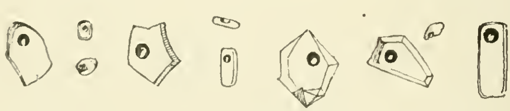


Fig. 3—Liquid cavities in natural ruby and sapphire (enlarged 100 diameters).

prism on the top of the cabochon. I have failed to find any of them in the stones under consideration, or even any of the marking of the hexagonal crystal which can often be seen when a gem is held in a good light, and the light allowed to strike obliquely across the hexagonal prism. Dr. Isaac Lea has suggested[1] that these acicular crystals are rutile, and interesting facts and illustrations have been published by him. From my

[1] Proc. Philad. Acad. Sc., Feb. 16, 1869, and May, 1876.

own observations on many specimens, I believe there is little doubt of the truth of this hypothesis.[1] My explanation is, that they were deposited from a solution, either heated or cold, while the corundum was crystallizing, and I doubt very much whether they will ever be found in any substance formed by fusion.

The hardness of these stones I found to be about the same as that of the true ruby, 8.8, or a little less than 9, the only difference being that the artificial stones were a trifle more brittle. The testing point used was a Siamese green sapphire, and the scratch made by it was a little broader but no deeper than on a true ruby, as is usually the case with a brittle material. After several trials I faintly scratched it with a chrysoberyl, which will also slightly mark the true ruby.

The specific gravity of these stones I found to be 3.93 and 3.95. The true ruby ranging from 3.98 to 4.01, it will be seen that the difference is very slight, and due doubtless to the presence of the included bubbles in the artificial stones, which would slightly decrease the density. As a test, this is too delicate for jewelers' use ; for if a true ruby were not entirely clean or a few of the bubbles of air that sometimes settle on gems in taking specific gravities were allowed to remain undisturbed, it would have about the same specific gravity as one of these artificial stones.

I found, on examination by the dichroscope, that the ordinary image was cardinal red, and the extraordinary image a salmon red, as in the true ruby of the same color. Under the polariscope, what I believe to be annular rings were observed. With the spectroscope, the red ruby line, somewhat similar to that in the true gem, is distinguishable, although perhaps a little nearer the dark end of the spectrum.

The color of all the stones examined was good, but not one was as brilliant as a very fine ruby. The cabochons were all duller than fine true stones, though better than poor ones. They did not differ much in color, however, and were evidently made by one exact process or at one time. Their dull appearance is evidently due in part to the bubbles. The optical properties of these stones are such that they are evidently individual or parts of individual crystals, and not agglomerations of crystals or groups fused by heating.

[1] Paper on star garnets, N. Y. Acad. Sc., May, 1886.

In my opinion, these artificial rubies were produced by a process similar to that described by Fremy and Feil (*Comptes Rendus*, 1877, p. 1029), by fusing an aluminate of lead in connection with silica in a siliceous crucible, the silica uniting with the lead to form a lead glass, and liberating the alumina, which crystallizes out in the form of corundum in hexagonal plates, with a specific gravity of 4.0 to 4.1, and the hardness and color of the natural ruby, the latter being produced by the addition of some chromium salt By this method rubies were formed that, like the true gem, were decolorized temporarily by heating.

It is not probable that these stones were formed by Gaudin's method (*Comptes Rendus*, xix., p. 1342), by exposing amorphous alumina to the flame of the oxyhydrogen blowpipe, and thus

Fig. 4.—Acicular crystals in sapphire (enlarged 100 diameters).

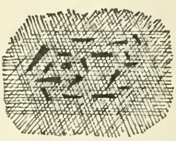


Fig. 5.—Cuneiform crystals in ruby and sapphire (enlarged 200 diameters).

fusing it to a limpid fluid, which, when cooled, had the hardness of corundum, but only the specific gravity 3.45, much below that of these stones. Nor is it at all likely that they were produced by fusing a large number of natural rubies or corundum of small size, because by this process the specific gravity is lowered to that of Gaudin's product. The same also holds good of quartz, beryl, etc.

The French syndicate referred the matter to M. Friedel, of the Ecole des Mines, Paris, supplying him with samples of the stones for examination. He reported the presence of the round and pear-shaped bubbles, and determined the hardness and specific gravity to be about the same as in the true ruby. On analysis, he found them to consist of alumina, with a trace of chromium for the coloring matter. The cleavage was not in all cases distinct, and the rough pieces given to him as examples of the gem in its native state had all been worked, so that nothing could be learned of their crystalline structure. When properly cut according to axes, they showed the annular rings. The extinction by parallel light was not always perfect, which he believed to be due to the presence of the bubbles. He states that he

himself has obtained small red globules with these inclusions by fusing alumina by oxyhydrogen flame ; and, although having no positive evidence, he believes these stones to be artificially obtained by fusion.

On the receipt of M. Friedel's report, the syndicate decided that all cabochon or cut stones of this kind shall be sold as *artificial*, and not precious gems. Unless consignments are so marked the sales will be considered fraudulent, and the misdemeanor punishable under the penal code. All sales effected thus far, amounting to some 600,000 or 800,000 francs, shall be cancelled, and the money and stones returned to their respective owners.

The action taken by the syndicate has fully settled the position which this production will hold among gem dealers, and there is little reason to fear that the true ruby will ever lose the place it has occupied for so many centuries. These stones show the triumph of modern science in chemistry, it is true ; and although some may be willing to have the easily attainable, there are others who will want, what the true ruby is becoming to-day, the almost unattainable. One will be nature's gem, and the other the gem made by man.

NOTE ON VANESSA ANTIOPA, L.

BY E. B. GROVE.

(*Read May 6th*, 1887.)

The objects which I have on exhibition to-night are, as mentioned in the programme—" Egg-shells of the Vanessa Antiopa," and the reason for their being selected for exhibition was not that they in themselves are either very beautiful or rare objects, but rather for certain facts concerning the life-history of the insect.

It is known to entomologists by the various names of " *Vanessa Antiopa*, cloaked Vanessa, *Papilio Antiopa*," and "Camberwell Beauty ;" but the name generally used in its classification, is the one originally given to it by Linnæus, *i. e.*, " *Vanessa Antiopa.*"

It is one of the most common butterflies, both in this country and in Europe. Dr. Packard thinks that it has probably been

imported into America, and is not indigenous to this country. Its wings are of a purple-brown on the upper side, with a broad buff-yellow border, in which is a row of pale blue spots. Of course like all of the Lepidoptera, variations, more or less in the general coloring, have been noticed—*vide* the *Canadian Entomologist* for September, 1876, which mentions that a large number of the *Vanessa* had been seen that year, having the border of the wings of a creamy white color, instead of the usual orthodox buff.

The larvæ are of a cylindrical shape, covered with black spines, spotted with small white spots, and with a row of darkish red spots on the back. They are rather social when young, and, like all of the *Vanessa* family, are extremely destructive to the vegetation on which they feed. They are not at all fastidious, or delicate in their food selections. I have found them feeding on the Willow, Elm, Poplar, Balm of Gilead and Ailanthus trees, and also on various plants, such as the Castor-Bean, and Geranium.

In this connection I noticed a very peculiar fact last Summer in my garden. There was a colony of the larvæ feeding on a large Castor-Bean leaf, and I discovered that they were arranged in a segment of a circle, their heads all pointing inward to a common centre. This same fact was also noticed in a second brood, later in the season.

This butterfly has two broods each season. The second, or Fall brood hybernates through the Winter, hiding in hollow trees, under logs and bridges, and in barns and other out-houses. I once found in December, under a foot-bridge over a small creek, a colony of at least fifty of these butterflies, all hanging by their feet, with antennæ and wings folded, and to all outward appearance lifeless. But, when touched or breathed upon, they showed signs of life, by slowly unfolding their wings. They have often been seen, on bright, sunny days, in the months of January and February, flying lazily around, and hovering over the snow.

The perplexing query to my mind is, how do they exist during their period of hybernation ? What supports life and supplies animal heat ? We know that their food consists simply and only of the honey-like nectar, secreted by flowers, that their digestive apparatus is the same as that of other Lepidoptera ; and that they are not provided with any supplementary stomachs, or other

organs of a like nature, in which a supply of food could be stored away for use when required. Neither do they make any provision, as do the Bees and Ants, in view of such a prolonged existence through the Winter months. Yet there must be some supply of food to keep their temperature above the freezing point. I have examined closely, and dissected many of them, after their long Winter sleep, and could not find that they had suffered at all from the want of food, nor had their internal organs any appearance of starvation. Yet take a perfect butterfly, of the first, or Summer brood ; confine it without food or water, and its life is of very short duration.

The bears, during their Winter sleep, are said to suck their paws ; but our poor flutterer has no paws to suck. Neither has it a mouth fitted to suck the paws.

It is known that all the hybernating animals keep up their heat—and heat is *life*—by utilizing the stores of fat, deposited next to the skin ; these stores of fat being secreted during the Summer months. But no matter how fat they may be when they go into their hybernating sleep, they invariably come out in the Spring in an almost starving condition.

But, as stated above, careful examination of specimens of the *Vanessa*, both before and after hybernation, fails to show any perceptible difference in the appearance of either the internal or external organs, that could be attributed to the want of food.

It is a well-known fact, that the chrysalis, or pupa form, can withstand an extreme degree of cold, as has been shown by the numberless experiments made by Reaumur, and also by Kirby and Spence. But is not that due to the facts, that the larva has stored up, for just this purpose, a large quantity of fatty matter —*corpus adiposum*—and that it is virtually in a transition period —neither larva nor imago ? The hybernating beetles, and certain long-lived larvæ of both beetles and butterflies, are either in, or surrounded by their natural food. But where can the food be found for the butterfly, during the Winter months ?

Newport states that " during hybernation, the act of breathing, like the circulation of the blood, almost ceases ; that the heat of the body is greatly lowered ; and the development of heat, in invertebrates as well as in vertebrates, depends upon the quantity and activity of respiration, and the volume and velocity of the circulation." This is true. But, even during the sluggish

torpor of hybernation, there must be a degree of temperature sufficiently high to prevent freezing.

There is no perceptible difference between the imago—the butterfly—of the early and late broods of the *Vanessa.* But I think, that the shells of the eggs, deposited in the Spring, by the hybernating female, are much harder and more "shell-like" in their nature, than those deposited by the females of the next brood ; and that the larvæ of the second brood consume more food than those of the first brood. In point of fact I am positive of the last assertion. I have in years past reared large numbers of the *Vanessa,* from the egg to the butterfly, in my cocoonery. And, for a number of seasons, I have selected several larvæ of each brood, of as nearly as possible the same size and healthfulness, and weighed the quantity of food consumed by each lot. I found, in every case, that the larvæ, which produced the late, or hybernating butterflies, consumed between five to ten per cent. more food, during the period embraced between the tenth day after hatching, and the day of transformation into the pupa, than those of the earlier brood.

In closing these brief and dry notes, I will say, that there are many points connected with the life of the *Vanessa,* and many obscure data to be cleared up, that are worthy of the attention and close study of any one, whether he be an entomologist or not.

HAIRS OF THE PEACH IN RELATION TO HAY FEVER.

BY THE REV. J. L. ZABRISKIE.

(*Read Oct. 7th,* 1887.)

Dr. Edward Woakes, of London, Senior Aural Surgeon, and Lecturer on diseases of the Ear at the London Hospital, in a work published by him during the present year, entitled "Nasal Polypus with Neuralgia, Hay Fever, and Asthma in relation to Ethmoiditis," London, 1887. pp. 140, remarks on p. 74, "Leaving for a moment all references to the exciting causes of Hay Fever, it will be desirable to devote some preliminary remarks to what may be described as the persistent pathological state of the nasal organs in this disease. Dr. Daly, of Pittsburgh, U. S.

A., was the first to publish any observed data on this subject, in 1881, when he clearly established the important fact that Hay Asthma was due in numerous instances to intra-nasal hypertrophies; and further, that the cure of these was followed by the disappearance of the disease. This position he ably supported at the International Medical Congress of 1884. Corroborative testimony to the same effect was given on this occasion by Dr. Roe, of Rochester; and numerous writers have since confirmed this view. At the same congress, Dr. Bosworth, of New York, recorded the important case, in which a foreign body had been impacted in the nose for many years, and had given rise to Hay Fever over a period of eight years. Dr. Bosworth adds, 'The attacks disappeared on removal of the stone' (Transactions of the International Congress, eighth session, Copenhagen, vol. iv., p. 110)."

And on p. 75, "Now the conditions present in the nose of a patient prone to Hay Fever are, according to the author's observations, one of two kinds, both of which implicate this tear-flowing zone. Either there is ethmoiditis in an early stage, often with very little enlargement of the spongy process—though this may, however, be very marked—but showing a glazed or shiny surface from loss of its epithelial covering, this denuded surface being readily irritated by external causes, and resenting these by excitation of normal reflexes; or there exists a narrow conformation of the nose—which may be quite natural, and possibly congenital—in which the opposing surfaces of the septum and middle spongy bones lie in near approximation throughout, and in some places actually touch each other. Such a nose as this last described might present even to a careful observer nothing to suggest abnormality. And yet it is abundantly clear that the close contact of sensitive surfaces designed normally for free exposure in the breathway, whether induced by disease or congenital formation, must compress, and therefore become a source of irritation to the delicate nerve-fibrillæ with which their investing membrane is endowed.

"Perhaps this latter fact may explain the observation that the disease under discussion is most prevalent among the aristocratic classes, who are generally accredited with the possession of that refined contour and delicate 'chiselling' of the nasal organ, which necessarily diminishes the space for the internal struc-

tures, and compels some of these to lie in contact with each other."

And again, p. 79 "Given this condition of preparedness, and it is clear that many emanations, too subtle for the healthy subject to detect, become transformed into very real sources of irritation to those who are so circumstanced as to possess it. The tendency to suffer such derangement is in no case, probably, the consequence of any peculiarly irritating endowment of the emanation itself. The phenomena following its access to the nose result from the fact that it falls, not upon healthy tissues, but upon a surface rendered susceptible by the loss of its epithelium, and already irritated by structural disease, or its equivalent—pressure. A trivial additional irritant then suffices to excite the reflexes proper to the nerve-supply of the affected area."

Whatever may be the doubts and disputations on this subject in other countries, it is evident that among the numerous sufferers from this disease in the United States there is overwhelming testimony to the fact that the distressing symptoms of Hay Fever are induced by the inhalation of vegetable substances, such as pollen, dust, hairs, the odorous exhalation of certain grasses, as of the Sweet Vernal-Grass (*Anthoxanthum odoratum*, L.), &c.

It is well known that Hay Fever patients are sometimes peculiarly susceptible to distressing symptoms induced by contact with the skin of the Peach. There are subjects of this malady who could not be enticed by any considerations even to pass wittingly under a fruit-laden peach-tree. For they know that the consequence of even a near approach to the tree would be a more or less severe attack by their old enemy.

An esteemed acquaintance, a subject of Hay Fever, who, during our late war, in the Fall of 1863, commanded a large body of dismounted troopers of the Ninth Michigan Cavalry, in East Tennessee, reports that, while his men were deployed as skirmishers, and pushed well up the side of the mountain at Cumberland Gap, engaged in almost continuous fighting for three days, his head-quarters were in a peach-orchard, and his tent pitched under a large peach-tree, where he was obliged to remain when not called to other parts of the field. When the enemy surrendered and the excitement of the conflict was over,

he found that his insidious, feverish foe had plied him so hard, that his eyes were useless, and the discharge from his nose so copious, and the accompanying cough so continuous that his fellow officers considered him to be in the last stages of consumption. But a few days rest at Knoxville, some fifty miles distant, restored him to duty. Great excitement, in his case at least, seemed to arrest the symptoms of the disease. For he also reports, that, on another occasion, he went into battle while suffering severely from Hay Fever, and during the intense excitement of action the symptoms passed away, only. however, to return with redoubled violence when the fighting ceased.

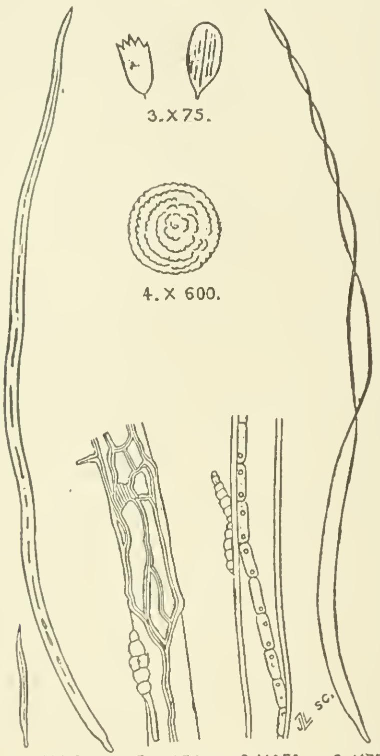
In the former days of "low necks and short sleeves" we have known of little girls, who could not be tempted twice, even by the abundant and luscious fruit of a New Jersey peach-orchard, to venture under the trees and secure the coveted prize, without the protection of some large outer garment thrown over the shoulders. They had been warned by an almost unendurable, burning irritation of the exposed, delicate cuticle, occasioned by the soft, but deceptive down from the beautiful fruit.

This down is formed by an abundant growth of vegetable hairs, springing from every portion of the skin of the Peach. A usual number, apparently, is about 7,000 hairs to the square inch. If a Peach of fair size has about twelve square inches of surface, then there may be found upon the one specimen no less than 84,000 hairs. And the abundance of these minute instruments of torture upon even one tree in full fruit is almost inconceivable.

These hairs are slender, cylindrical, unbranched, smooth, glassy, quite sharply pointed at the distal end, and suddenly tapered at the base. They are from .01 to .06 of an inch in length, and about .001 of an inch in average diameter. They are provided with a tubular cavity running through the entire length nearly to the pointed extremity. In the plump, vigorous and apparently growing hairs this cavity is extremely small in diameter, and is often interrupted, or at least invisible, in numerous portions of its length. In the hairs which appear to be older, the cavity is larger in diameter, and is frequently filled in detached portions with granular matter, and also frequently, and especially near the base, shows bubbles of air. And finally there are some of the longest hairs which are evidently exhausted ;

for they are twisted, flattened and collapsed, until there appears to be nothing remaining excepting the thin cellular walls.

The thickly felted surface of the fruit affords an excellent trap for entangling particles floating in the atmosphere. Occasionally lepidopterous scales, and delicate scales of other orders



HAIRS OF THE PEACH.

FIG. 1.—Two Hairs ; one, of the greatest observed length, showing bubbles in the lower portion of the central cavity ; the other of the least length.
FIG. 2.—An exhausted Hair ; dried, flattened, and twisted.
FIG. 3.—Lepidopterous scales.
FIG. 4.—A pollen grain.
FIG. 5.—A spore, and fungoid growth upon the surface of a Hair.
FIG. 6.—Two spores upon, and nucleated fungoid growth within an exhausted Hair.

of insects will be observed clinging to the hairs. Very frequently pollen-grains will be found, especially those of the most common Rag-weed (*Ambrosia artemissiæfolia*, L.) Various minute particles of inorganic matter of all colors abound. And

what perhaps is most ominous, fungoid spores will be seen continually, especially the spores of some *macrosporium*, which genus grows abundantly parasitic upon languishing vegetation. In the lower left-hand portion of Fig. 5 is a representation of one of these spores adhering to the surface of a hair—a compound, six-celled spore with a lengthened pedicel. These spores vary greatly in their number of cells, and their general outline, but this is a typical specimen. On one occasion fifteen of these spores were found clinging to one hair. Where spores abound there will also frequently be observed threads and meshes of mycelium, extending sometimes over the entire length, and evidently upon the surface of the hair ; because the threads of the mycelium can be seen frequently to extend beyond the contour of the hair, and occasionally to send out delicate processes beyond that contour, nearly at right angles to the general direction of growth. Occasionally within the older, flattened hairs may be detected a very striking nucleated fungoid growth, as represented in Fig. 6.

The action of the Hairs of the Peach in a case of Hay Fever is probably mechanical. We may well suppose that multitudes of these microscopic needles, lodging in the air-passages, would have the effect of making the inflamed membranes ten times more inflamed. But there may be something more. It may be that the multitudes of pollen-grains and spores, caught in this remarkable trap, so set day and night continually while the fruit is growing, and then liberated on the occasion of their insidious attack, accomplish a chemical and poisonous action upon the exposed and susceptible membranes.

It may be a sufficient hint on this matter to refer to the record given in Ziemssen's Cyclopædia of the Practice of Medicine, concerning the systematic experiments, made upon himself with various substances by C. H. Blackley. When in these experiments he used the spores of the mould, *pencillium glaucum*, the effects were hoarseness increasing to aphonia, bronchial catarrh, etc., which lasted for some days. (Am. Ed. by A. H. Buck, M. D., 1875, Vol. II., p. 545.)

Dr. Woakes, in the publication already cited, p. 79, says: "The radical treatment of Hay Fever, as the foregoing observations will suggest, is chiefly surgical." He refers to the removal or reduction of abnormal irritating growths in the nasal pass-

ages, and continues—"One caution only is necessary ; it is that the patient should not be submitted to surgical manipulations during an acute access of symptoms ; an interval of repose should be chosen for this purpose either before or after an attack."

While disclaiming any knowledge of the disease, which would enable me to intelligently indorse or controvert the statements of Dr. Woakes on its nature and proper treatment—which matters are left to the physicians and surgeons—I nevertheless consider his chapter on Hay Fever a remarkably clear exposition of some of the characteristics and accompaniments of this disease, and have quoted that chapter as an introduction to what I have seen and heard of the Hairs of the Peach.

MISCELLANEA.

PHOTOMICROGRAPH VERSUS MICROPHOTOGRAPH.—By A. Clifford Mercer, M. D., Syracuse, N. Y.—The confusion of the terms "photomicrograph and "microphotograph" has led the writer to try to discover the paternity and original meaning of the more important word, photomicrograph.

During the past eighteen months, through the kind interest of Dr. R. L. Maddox, himself, and through him of the editors of the *British Journal of Photography* the looked-for paternity has been discovered. Traced to Mr. George Shadbolt, he has acknowledged the child, writing : "I believe I am responsible for drawing attention to the necessity of a distinction between a photographic picture of an enlarged object, and the minute photographic picture of a large object, the former being correctly described as a 'photomicrograph,' and the latter as a 'microphotograph,' in accordance with the meaning of the original Greek derivatives. This will have been in an early number of the *British Journal of Photography*, probably while it was still called '*The Liverpool Journal of Photography.*'"

The exact date of the birth of the word is still somewhat doubtful, but Dr. Maddox writes : "I think we may safely put it at '59 or '60, although we cannot put our finger on the page, even after much research."

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OF THE

New-York Microscopical Society.

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AGENT FOR GREAT BRITAIN.

The two acknowledged leaders in photomicrographic literature in the two great English-speaking countries, Drs. Maddox and Woodward, throughout their writings have used the words in question with the clearly defined Shadbolt distinction; and the writer trusts, with this historical note recorded in our Proceedings, the American Society of Microscopists, as a body and as individuals will insist upon the correct usage of these terms.

A photomicrograph is a macroscopic photograph of a microscopic object; a microphotograph is a microscopic photograph of a macroscopic object.

Discussion.—In discussing this paper, Professor W. A. Rogers took occasion to recommend the use of the term *mikron* instead of micromillimeter, in which Professor W. H. Seaman concurred.—*Proc. Am. Soc. Microscopists* in *Microscopical Bulletin and Science News.*

Tests for Definition, Penetration, &c.—The *Microscopical Bulletin and Science News*, Aug., 1887, takes the following admirable extract from the *English Mechanic*, by E. M. Nelson.

"This is an important subject, about which a great amount of misconception exists. Let us first get at the meaning of the words. According to Goring, Pritchard, and Brewster in 1837, 'Quekett,' second edition, 1852, 'Jabez Hogg,' second edition, 1855, penetration or 'separating power' = resolving power; definition = freedom from spherical and chromatic aberrations. So also *Micrographic Dictionary*, third edition, 1875, with this exception, that according to it, separating power = magnifying power. In 'Carpenter,' fifth edition, 1875, penetration = focal depth; so also in 'Beale,' fifth edition, 1880. Probably the term 'penetration' came to mean resolution from the phraseology used in connection with Herschel's monster telescope 'penetrating' into space, and resolving very minute stars, which were thought to be immensely farther off than the more conspicuous ones.

"The word 'penetration' is now used solely with reference to depth of focus.

"The qualities of an object glass are six in number:

1. Magnifying power.
2. Resolving power.

3. Penetrating power.
4. Illuminating power.
5. Flatness of field.
6. Defining power.

"1. No test is required for this, as it can be directly measured. Imagine anyone saying that a scale of *Morpho Menelaus* was a good test of magnifying power!

"2. Resolving power is simply numerical aperture, or *N. A.* This can also be directly measured, therefore no test is necessary.

"3. Penetrating power is the reciprocal of resolving power, $\frac{1}{N.\ A.}$; no test is necessary.

"4. Illuminating power is $(N.\ A.)^2$, or *N. A.* multiplied by itself; no test is necessary.

"5. Flatness of field. Tests: for low powers, a microphotograph; for medium powers, a stage micrometer; for high powers, a slide of minute bacteria or micrococci, dried on cover and stained. This is not so important as usually supposed, especially in high powers.

"6. Defining power depends, as we have seen, on the freedom of the lens from spherical and chromatic aberrations. Of these two, the spherical is the all-important one.

"Of the method of testing lenses for this point, I have treated already at length in these columns, and therefore will merely say that it is performed by viewing a suitable object illuminated by solid right cones of light, the object being placed in the apex of the cone. Cones of small angles should first be used, and then enlarged until the object begins to get pale, milky, or foggy. On removing the eye-piece and looking down the tube at the back lens of the objective, it will be seen what portion of the lens is filled with light, thereby determining at what point in the aperture of the objective the spherical aberration begins to operate, the best lens being that which will stand the most light. Flooding an object with too much light is only another name for spherical aberration in the object-glass. A good objective is one which cannot be flooded.

"Suitable tests for spherical aberration:

"Very low powers, 3, 2, 1½ in.; wing of *Agrion pulchellum* ♀ (Dragon-fly).

"Low powers, 1, ⅔ in.; proboscis of Blow-fly, squeezed flat.

"Medium powers, $\frac{1}{2}$, $\frac{4}{10}$, low-angled $\frac{1}{4}$ in.; minute hairs on proboscis of Blow-fly; hair of Pencil-tail (*Polyxenus lagaries*); diatoms on a dark ground.

"Medium powers, wide angled, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$ in.; *P. formosum* and *N. lyra* in balsam or styrax; bacteria and micrococci stained.

"High powers, wide angled immersions; the secondary structure of diatoms, especially the fracture through them. *Navicula rhomboides* in balsam or styrax, bacteria and micrococci stained.

"Chromatic aberration is not so important as the spherical, because some very fine object-glasses have a great deal of outstanding color.

"Tests for low powers; thin sections of deal, the coarse structure. Medium powers; the discs in ditto. High powers; *Podura* scale and *P. formosum.* So it will be seen that there is only one point of paramount importance in an objective to be tested, and that is its spherical aberration. The other qualities can be measured."

Mounting Diatoms in Situ.—The following correspondence, published ten years ago, will well bear repetition, on account of the excellence of the methods advocated, and may perhaps, be a valuable reminder to some one looking for advice. "It is often desirable to mount diatoms *in situ*, as they grow attached to algæ or other aquatic plants, either to illustrate their mode of growth, or to obtain them when in too small quantity for any of the processes of separating or cleaning.

"I have never found any method of mounting satisfactory until I tried the following, which with all the algæ that I have tested, gives satisfactory results.

"The algæ are thoroughly dried, as usually stuck on paper. It is presupposed that all extraneous dirt has been removed. I have provided a slide with a circle of ink, marking the center on the reverse side, after the plan of my friend, Prof. C. Johnston, cover glass, a bottle of Canada balsam solution in chloroform, a bottle of chloroform and a watch-glass, all ready, as the operation must be carried through quickly. I select a bit of the seaweed, just large enough for the mount; put a drop or more of the chloroform in the watch-glass, and immerse the bit. The chloroform seems to be as efficient as water in restoring the dried alga to its natural shape. As the chloroform evaporates rapidly

it is well to add more drops to the watch-glass, until the alga is well permeated by the fluid and appears natural ; it is then transferred to the slide with a drop or two of chloroform, arranged for exhibition, and then the balsam dropped on immediately before the fluid has evaporated, and then the cover may be applied.

" Prepared in this manner, the balsam follows the chloroform, and penetrates the cells of the sea-weed, making them translucent, and showing the details of their structure admirably, while the diatoms are displayed conspicuously in their natural connection. The balsam must be hardened slowly, as it will not do to apply heat of a temperature that will shrivel the alga. Of course every algologist knows that in this mode but seldom can the specific marks of a diatom be made out ; but the not less important facts of the mode of growth, can be shown, as they cannot be with cleaned diatoms.

" I have now before me a slide holding a Ptilota from the Pacific, which displays finely several species of diatoms that I have seen no trace of until this method was tried. I can heartily recommend it to those who have collections of algæ."—CHARLES STODDER.

" N. B.—Instead of putting the specimen in a drop of chloroform in a watch-glass, where it evaporates in a few minutes, when it is convenient it may be better to put several specimens in a very small bottle of the menstruum, and take them out as wanted, transferring direct to the slide, or to the watch-glass, as preferred. In this way they may be well saturated with chloroform. The next important matter is to add the balsam before the chloroform has all evaporated."—C. S. in *The American Journal of Microscopy*, Vol. II. (1877), p. 142.

MOUNTING ALGÆ.—" The article by Mr. Charles Stodder in your last number on ' Mounting Diatoms in Situ,' was not without considerable interest to me, and no doubt to others who have tried their hands at mounting marine algæ in a way to show their best points. I believe that workers in microscopy should do as good camp-meeting attendants do—every one should get up and relate his or her experience. Now as I have done considerable lately in the way of mounting marine algæ, I think it my duty to advocate the use of the material that has given me the most satisfactory results, *i. e.* salicylic acid. My process is

as follows: by using sea-salt (which can be bought for a trifle at any first-class druggists) and distilled or rain water, a good substitute for sea-water is obtained; into this I immerse the rough dried specimens of algæ, and in an hour or two they have resumed their natural shape. Now picking out and clipping off such pieces as are best adapted for mounting, I transfer them to a bowl of distilled water and wash them clean, and from thence transfer them to a small saucer, containing a saturated solution of salicylic acid. The shallow cell into which they now go is built up of shellac cement made by dissolving bleached shellac in cologne spirits. Cells made of this substance are ready for use twelve hours after being laid on to the slide. I pick up the specimen with forceps, put it on the slide, and fill up the cell with the salicylic acid. I now breathe on the covering glass and put it in its place, and by the use of blotting paper absorb the superfluous fluid. A thin coating of gold size completes the work for the time being; in a day or two I lay on more gold size, and afterwards white zinc cement or brunswick black—the finish, of course, being a mere matter of fancy.

"In mounting a piece of algæ having *Isthmia* parasitic on it, it is almost impossible to fill these diatoms if balsam is used, whereas by the use of salicylic acid every valve will be filled. In some cases the medium I have used has robbed the alga of its color, but this occurs but rarely.

"I have now before me a slide of *Ptilota hypnoides* in full fruit, the beauty of which could never be brought out except by first immersing the specimen in the sea water I have referred to. For the study of algæ, direct light should be used, but using dark field illumination is the best way of making it a genuine 'Oh my!' slide."—H. F. ATWOOD, in *The American Journal of Microscopy*, Vol. II. (1877), p. 154.

THE "CURL" OF PEACH LEAVES, AND THE FUNGUS, EXOASCUS DEFORMANS.—The *Botanical Gazette*, Vol. XII., No. 9 (Sep., 1887), p. 216, publishes from "Contributions from the Botanical Laboratory of the University of Michigan, 1887," a most admirable article, by Etta L. Knowles, on "the disease of peach leaves, known as 'the curl,'" caused by the fungus "*Exoascus deformans*." The article is illustrated by a plate, with drawings of marked distinctness and beauty by the writer.

Dead Black on Brass, and as Ground for Opaque Mounts.—"The following process for preparing a dead black surface on brass, for optical instruments, &c., is given by *The Locomotive*: 'Take two grains of lamp-black, put it into any smooth, shallow dish, such as a saucer or small butter-plate, add a little gold size and thoroughly mix the two together. Just enough gold size should be used to hold the lamp-black together. About three drops of such size as may be had by dipping the point of a lead pencil about half an inch into the gold size will be found right for the above quantity of lamp-black; it should be added a drop at a time, however. After the lamp-black and size are thoroughly mixed and worked, add twenty-four drops of turpentine, and again mix and work. It is then ready for use. Apply it thin with a camel's-hair brush, and when it is thoroughly dry, the articles will have as fine a dead black as they did when they came from the optician's hands.'"—*The American Monthly Microscopical Journal*, Vol. VII. (1886), p. 37.

Mr. W. C. Brittan, says (*The Microscope*, Vol. VI. (1886), p. 41, "This paint will also be found just the thing when a dead black ground is required for opaque mounts."

THE SAN FRANCISCO MICROSCOPICAL SOCIETY.

Meeting of August 10th, 1887.

A CALIFORNIA DIAMOND.

PROFESSOR HANKS EXHIBITS A RARE GEM FOUND IN AMADOR COUNTY.

DISEASE GERMS AGAIN.—INTERESTING FINDS AT THE SEASIDE.—SINGING SAND AT PESCADERO.

The regular meeting of the San Francisco Microscopical Society was held in the society's rooms last evening, President Wickson and a large number of members being present. In the absence of Secretary Breckenfeld, Dr. C. P. Bates, of Berkeley, acted as Secretary.

Among donations to the cabinet were four slides of tubercular bacilli from Dr. Riehl, of Alameda, stained with different preparations. William Norris presented a recently issued part of Walker and Chase's series of "New and Rare Diatoms."

Mr. Norris remarked the singular beauty of some of the newly discovered diatoms. Those shown were from the Barbadoes deposits, a locality which has yielded fine finds of foraminifera.

Professor Henry G. Hanks read an interesting paper, illustrated by diagrams, concerning a diamond found in this state. The first diamond, he said, was found by Mr. Lyman, of New England, who saw in 1850, in the new gold mines, a crystal about the size of a small pea. It was slightly straw-colored and had convex faces. From that time to the present these gems have been occasionally found in our state, but never in large numbers nor of unusual size. Professor Hanks said it has been long his opinion that if hydraulic mining had been allowed to continue a system of concentration would have been adopted which would result in a larger production of gold and platinum and in the finding of more diamonds. At the present time we know of the existence of diamonds in five counties in the state, as follows: Amador, Butte, El Dorado, Nevada and Trinity. It is not unlikely that they may yet be found in California more plentifully than before.

A very beautiful and remarkable diamond has lately come into the possession of J. Z. Davis, a member of the Microscopical Society, and this one Professor Hanks submitted for examination. It was found in 1882 at Volcano, Amador county, by A. Schmitz. It weighs 0.361 grammes, or 5.570 grains, equal to 1.571 carats. It is a modified octahedron about three-tenths of an inch in diameter, very nearly if not quite colorless, perfectly transparent, but not without some trifling inclusions and faults. The form of the crystal is unusual. Professor Hanks has not found such a one described or figured in books. The general form as shown by examination is that of a regular octahedron, but the faces seem convex. The whole crystal assumes a somewhat spherical form and the edges of the pyramids are channels instead of planes, but on closer examination it will be seen that the channeled edges, the convex faces and the solid angles are caused by an apparently secondary building up of the faces of a perfect octahedron, and for the same reason the girdle is not a perfect square, but has a somewhat circular form. These observations were well shown by drawings showing in enlarged form the outlines of the gem. The faces seem to be composed of thin plates overlying each other, and each slightly

smaller than the last. These plates are triangular, but the lines forming the triangles are curved, and the edges of the plates themselves are beveled. Mr. Hanks remarked further that it could be seen by the enlarged crystal shown under the microscope and by drawings exhibited that each triangular plate was composed of three smaller triangles and that all the lines were slightly curved. The building up of plate upon plate causes the channeled edges and the somewhat globular form of this exquisite crystal. The sketches shown were made from the diamond, while in the field of the microscope by the aid of the camera lucida, being enlarged about ten diameters.

A close examination of the crystal revealed tetrahedral impressions as if the corners of minute cubes had been imprinted on the surface of the crystal while in a plastic state. These are the result of the laws of crystallography, as were seen by the faint lines forming a lace work of tiny triangles on the faces when the stone is placed in a proper light. Professor Hanks concluded with the remark that it would be an act of vandalism to cut the beautiful crystal which is a gem in two senses, and he protested against it ever being defiled by contact with the lapidary's wheel.

The diamond was placed under the microscope and arranged by Professor Hanks to demonstrate the points of his very accurate description. It was a beautiful object and was admired by all present.

Dr. Riehl, of Alameda, gave a demonstration of discovering tubercular bacilli in the sputum of consumptives. He proceeded with the operation of staining, decolorizing, etc., and finally showed the minute germs clearly under the lens. Dr. Riehl made no claim to originality in the method employed, but showed how he handled the material so as to disclose the bacilli quickly for purposes of diagnosis. Discussion ensued as to the value of different methods, Dr. Ferrar and Dr. Mouser maintaining the value of the careful and exact methods of procedure laid down by the German investigators for purposes of exact determination. Dr. Mouser showed a very handsome piece of apparatus called "Schlessing's Thermo Regulator," which he had just received from Germany. It is to be attached to the incubator used in cultures of bacilli, etc., in such a way that the water of the incubator comes in contact with the rubber plate of the regulator and expands it. This expansion of the rubber presses upon the

other parts in contact with it and partly closes the pipe, admitting gas to the jets which heat the incubator. The appliance is so delicate that an elevation of one-tenth of a degree in the heat will act upon the gas flame and reduce it.

President Wickson exhibited a specimen of sonorous sand sent to Professor Hilgard by W. G. Thompson, of Pescadero, and referred to him for examination. Mr. Thompson's letter explained that the sand when driven over or walked on or even disturbed with a stick or the hand, gives out a distinct musical sound. Perhaps the strangest thing about it is that the persons longest in the vicinity of Pescadero, seem not to know of the existence of such a place. It is away from the usual places of resort. The much-talked of "singing beach" of Manchester, Mass., is only one-fifth of a mile long while Mr. Thompson has traced this sand at Pescadero along the beach for over a mile and a half. Mr. Wickson remarked that the subject of sonorous sand had been before the society some years ago in connection with specimens sent from the Sandwich Islands and had been studied by Professor Hanks. The society's cabinet contains a slide of the Sandwich Island sand. The Pescadero material would be studied in the light of these facts, comparisons made, and the subject presented at a subsequent meeting. Specimens of the sand were distributed to those present.

J. Z. Davis showed a sample of kelp from the southern coast covered with minute shells of mollusca so that the green kelp seemed almost white. The subject was referred to Dr. H. W. Harkness, with the request that he report at a subsequent meeting.

The society then adjourned.

Meeting of August 24th, 1887.

INTERESTING MEETING.—WOOD FROM AN ARTESIAN WELL.—CURIOSITIES FROM MOUNT SHASTA.

The regular semi-monthly meeting of the San Francisco Microscopical Society, was held last evening at its rooms, 120 Sutter street. President Wickson occupied the chair.

Dr. Harkness made a preliminary report on the kelp covered by mollusca, which was referred to him at the last meeting. A more complete examination of the material will be made in due course.

The resignation of A. H. Breckenfeld, offered on account of his approaching departure for San Diego, was accepted. President Wickson spoke feelingly of the exceedingly pleasant relations which had always existed between the retiring officer and the society, and at the conclusion of his remarks a cordial vote of thanks was tendered Mr. Breckenfeld for his services as Recording Secretary. Under a suspension of the rules he was duly elected an honorary member of the society, and thereupon fittingly expressed his appreciation of the honor conferred. His successor will be elected at the next meeting.

A piece of wood, apparently fossilized, was sent in by Geo. A. Raymond, with the information that it had been struck at a depth of 325 feet in an artesian well now being bored in Kern county, Cal. The overlying material was mostly clay and the surrounding country was entirely destitute of timber. After an interesting discussion the specimen was referred to Prof. Hanks for microscopical examination.

Dr. Riehl donated a slide of a very minute larval form of insect, in which the vascular system was particularly clearly shown.

A varied assortment of entomological, botanical and mineralogical specimens was donated by F. L. Howard, who had collected them on the slopes of Mount Shasta. Some peculiar varieties of porous obsidian attracted much attention.

Mr. Riedy stated that the work of stamping the books, plates, etc., in the library with the cut recently adopted by the society had been commenced and would soon be completed.

The meeting thereupon adjourned to the 14th prox.

A. H. BRECKENFELD, *Recording Secretary*

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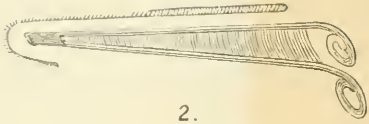

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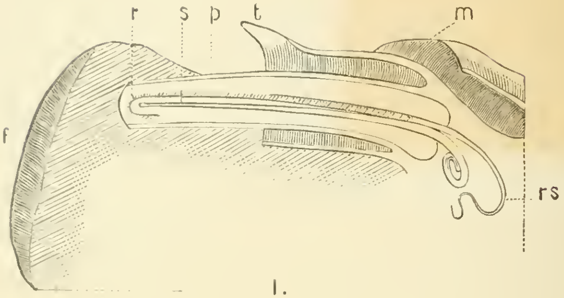

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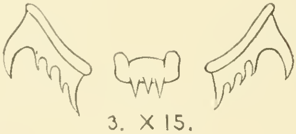

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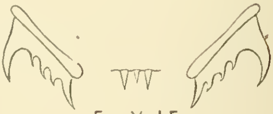

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J. L. Z. Del. ad Nat. et Sc.

RADULA OF THE CONCH.

JOURNAL

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NEW-YORK MICROSCOPICAL SOCIETY.

VOL. IV. JANUARY, 1888. No. 1.

THE RADULA OF THE CONCH, SYCOTYPUS CANALICULATUS, GILL.

BY THE REV. J. L. ZABRISKIE.

(*Read November 18th, 1887.*)

This species is, with one exception, the largest univalve mollusk inhabiting the coast waters of our State. It is common from the eastern borders of New England southward along the shores of New Jersey. The exception in size occurs in the case of *Fulgur carica*, Conr., a near relative, which is found from Cape Cod southward along the shores of the Southern States. The size of the adult shell of the first species is given as six inches in length, and that of the second species as eight inches. In the warmer waters of the South, this latter species is said to grow much larger. Both species are popularly known as the "Winkle," "Periwinkle," or "Conch." This latter name is prevalent among the dealers of the New York markets, where they are sometimes offered for sale.

These mollusks are now assigned to different genera, and are

Explanation of Plate 10.

FIG. 1.—Longitudinal-vertical section of the anterior portion of the Conch, *Sycotypus canaliculatus*, Gill, natural size; *f*, surface of the foot; *m*, the mantle; *t*, one tentacle; *p*, the proboscis; *s*, the skeleton; *r*, the radula; *rs*, the radular sack.

FIG. 2.—A perspective view of the skeleton, with the radula divested of some of its membranes, and elevated above its natural position; natural size.

FIG. 3.—One row of teeth, from the median portion of the radula, enlarged 15 diameters.

FIG. 4.—One row of teeth with worn and broken points, from the distal end of the radula, enlarged 15 diameters.

FIG. 5.—One row of teeth, from the proximal end of the radula, enlarged 15 diameters.

readily distinguished by the shell. *Fulgur carica* has the lower three volutions of the spire furnished with a series of distinct, triangular tubercles; while *Sycotypus canaliculatus*, devoid of tubercles, has the suture of the spire furnished with a deep, sub-quadrangular canal, gradually decreasing in size as it approaches the summit.

The shell of both species has a brown epidermis. In the case of *Sycotypus* this epidermis supports bristly hairs, about one-quarter of an inch in length, whose bases are so regularly disposed on longitudinal ridges of the epidermis as to give the appearance of minute longitudinal and transverse striations, separated by a distance of about one-fortieth of an inch.

The horny, flat operculum, which effectually closes the orifice only when the animal has deeply retired within the shell, is perhaps comparatively small as respects the size of that shell.

The egg-cases of both species, from their large size and curious form, are always objects of interest when first observed. They are popularly known as "sea-necklaces." They consist of a number of capsules—from fifty to one hundred—of a very tough, parchment-like material, of a flattened, elliptical form, about one inch broad, in close succession overlapping each other, and connected at one edge by a stout and very strong filament of the same material, two feet or more in length. The capsules of *Sycotypus* have the edge acute, and the broad, upper surface crossed by ten to twelve prominent radiating ridges. The capsules of *Fulgur* have the edges truncate and ridged, with the broad surfaces smooth. These capsules contain each sometimes as many as forty eggs. The young, as they mature, issue from the capsule by breaking through a small, thin portion of the membrane near the edge opposite the retaining cord of the "necklace." The "necklace" is always imperfect at one end, this portion consisting merely of the strong cord and a few scattered immature capsules. Until recently it has been doubtful which end is first extruded from the oviduct. But I have found the late accounts confirmed by the testimony of an acquaintance who is observant, and well-versed in the habits of these mollusks. He informs me that he has often captured them with the "necklace" half extruded, and that the imperfect end is always laid first attached to some object just below the surface

of the sandy bottom, in the shallow waters where they are seen to spawn.

On account of the opportunity of seeing it alive, in its native haunts, I have been interested in *Sycotypus*, especially since July just passed. My first living specimen was presented by Mr. Duffield Prince, who captured it in the Wallkill, a branch of Flatlands Creek, near Coney Island. My second living specimen was presented by Mr. Stephen Williamson, of Gravesend, Long Island, and was also captured near the place mentioned above. This is the specimen exhibited at the present time. The shell is unusually large, measuring $6\frac{11}{16}$ inches long, by $4\frac{1}{16}$ inches broad. This specimen was spawning at the time of capture. The "necklace" of egg-capsules, fourteen inches long, also here exhibited, was partially extruded; each fully-formed capsule containing a number of eggs. I have also been kindly presented with a number of specimens by the Hon. E. G. Blackford, Chief of our State Fishery Commission.

THE RADULA.—This organ of mollusks known by the names, "tongue," "palate," "lingual ribbon," "lingual membrane," "odontophore," or "radula," has always been interesting to microscopists on account of its singular mechanism and beautiful form. It is so universally present in the univalve mollusks that, in modern works of any extent, mention of its form at least is expected, if its dentition is not figured, under every important genus.

Prof. E. Ray Lankester, in the ninth edition of "The Encyclopædia Britannica," divides all the groups of *Mollusca* into two main branches—(1) *Lipocephala*, or headless; with the head-region undeveloped, no cephalic eyes, and the buccal cavity devoid of biting, rasping, or prehensile organs; containing only one class, the *Lamellibranchia*, including the mussels, oysters, cockles and clams. (2) *Glossophora*, the tongue-bearing mollusks; having not only a "well-developed head, but a special aggresive organ in connection with the mouth which on account of its remarkable nature, and the peculiarities of the details of its mechanism, seems to indicate a very close genetic connection between all such animals as possess it." In the *Glossophora* he includes the three great classes, *Gasteropoda*, *Scaphopoda* and *Cephalopoda*, intimating that as a rule, all the numerous orders of the *Glossophora* possess the radula.

Huxley, in his "Anatomy of Invertebrated Animals," states that the Odontophorous Mollusks, in which division he includes all which stand in contradistinction to the acephalous Lamellibranchs and Brachiopods, possess the radula, with the exception of a very few genera, *e. g.*, *Tethys*, *Doridium* and *Rhodope*.

Tryon, in his "Structural and Systematic Conchology," says "in a few Gasteropods the tongue is unarmed."

Our admirable Government Report on "The Fisheries and Fishery Industries of the United States" (Section I., p. 695, 1884), makes an unfortunate slip in stating that the Conch is not provided with a "file-like tongue."

But our Conchs are not lacking in this armature. Here is the radula, preserved entire in glycerine, of the identical specimen of *Sycotypus*, whose shell is at present exhibited. The armed portion is a little more than two inches in length, and about one-eighth of an inch broad, at the flattened, distal end. And here is the radula of *Fulgur*, preserved in the same manner, entire, and quite closely agreeing in size and form with that of its relative.

Prof. Lankester, in "The Encyclopædia Britannica," already cited, gives an admirable longitudinal-sectional illustration of the mouth-parts of a glossophorous mollusk, and in the accompanying explanation clearly describes the action of the radula in life, *i. e.*, the forward, effective portion of the organ rasps off the food by an alternate backward and forward motion, caused by the alternate rolling of a globular mass of cartilage firmly attached to the under side of the bed of the radula, near the oral aperture. And he adds, "But in many *Glossophora* (*e. g.*, the Whelk) the apparatus is complicated by the fact that the diverticulum itself, with its contained radula, rests but loosely on the cartilage, and has special muscles attached to each end of it, arising from the body-wall; these muscles pull the whole diverticulum, or radular sack, alternately backwards and forwards over the surface of the cartilage."

This is very nearly the description of the organ and its action in the species under consideration. In *Sycotypus*, the radula, as usual, consists of an assemblage of transverse rows of chitinous teeth, situated upon the upper surface of a thin, but very strong chitinous ribbon, lying longitudinally in the floor of the long

proboscis-like mouth. The ribbon, firmly attached to a strong bed, or subradular membrane, rests loosely upon, and passes over and under the anterior end of a cartilaginous apparatus, named the "skeleton."

Huxley's description of the skeleton is that it is "composed of two principal masses of partially fibrous, or completely cartilaginous tissue, *odontophoral cartilages*, which may be more or less confluent, and are further united together in the middle line by fibrous and muscular tissue. Their anterior ends and oral faces are free and smooth, and are usually excavated so as to present a trough-like surface to the subradular membrane, which rests upon them."

In *Sycotypus* this skeleton has the form of an attenuated truncated triangle. The "odontophoral cartilages" forming the longitudinal borders of the triangle, are connected by a tough, transversely striated substance, and they each present along their entire upper surface a distinct, smooth, white trough for the free action of the subradular membrane. The radula, with its strong bed, rests upon this cartilaginous triangle, and its forward portion is bent over and underneath the truncated end of the triangle, in order to accomplish its intended work, which we will notice presently. The radula, when at rest and especially as regards the posterior portion, has the form of a tube, slit along the entire upper surface, causing the points of the teeth of this tubular portion to converge towards the axis of the tube. But where the anterior portion is flattened out, the teeth lie in transverse rows, with the points directed backwards ; and where the radula curves over the forward end of the skeleton the teeth necessarily raise their points, nearly perpendicularly to the surface of the membrane, giving the appearance of a very formidable weapon. The radular membrane is continued posteriorly in the form of a white, opaque, closed tube, constituting the radular sack. And the radula itself is the product of growth from the inner surface of this radular sack. As the teeth and the membrane are worn away by use at the anterior end, new teeth come into service, and the whole apparatus is preserved in its effectiveness by the growth of the radula at its posterior end, and its advancement along its entire length. The line of origin of the teeth in the radular sack is quite sharply defined, and the radula easily separates from the sack at this line of origin.

The radula of *Sycotypus* is so large that it is easily obtained by dissection. The following method was employed in the present instances. The living animal was dropped into boiling water, and allowed to remain there for five minutes. A steel fork was thrust into the muscular foot, and a forward, spiral, oscillating motion soon extracted the animal from its shell. The viscera being discarded, the mantle was slit backward along its upper region, disclosing the head, and the remaining mass was divided by a longitudinal incision through the great muscular foot, slightly at one side of the median line, disclosing, but leaving intact, the proboscis. Then by inserting one point of the dissecting scissors into the oral aperture, feeling the radula so as to be certain the instrument was lying upon, and avoiding all risk of injuring the desired organ, the proboscis was slit along its entire upper surface. The radula was then easily seen, seized with a forceps, and dissected out as far as could be followed.

As far as I have been able to ascertain the radular sack of *Sycotypus* continues inwardly for a length at least equal to that of the radula itself, until it becomes an attenuated thread, dips downwards and forwards in several loops, and has its origin underneath and near the junction of the proboscis with the foot. The specimens examined died with the radula bent over the forward end of the skeleton, continuing backward and underneath for varying distances, such as $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{9}{16}$ths of an inch. The specimens of radula here exhibited were cut into lengths of $\frac{3}{8}$ths of an inch, flattened by soaking in alcohol while compressed between two pieces of glass, and mounted in glycerine.

Under the first microscope is exhibited the central portion of the radula of *Sycotypus*, by polarized light, the teeth being in perfect condition, and giving strong contrasts of colors. There are three teeth in each row. Each tooth consists of a transversely extended plate, supporting several denticles. The central tooth has three denticles, and each lateral tooth has four, with sometimes an additional rudimental fifth denticle.

Under the second microscope is exhibited the distal end of the radula, where it will be observed the membrane itself is ragged, and the teeth sometimes entirely dislodged, and when remaining having the points broken and worn from hard usage.

Under the third microscope is exhibited the proximal end of the radula. The teeth gradually become smaller and fainter,

and yet their origin, as well as that of the chitinous foundation is sharply defined.

The teeth lie quite flat upon the horizontally extended radula, with their points directed backwards towards the interior of the mouth. And it is evident that the effective stroke of the organ when acting upon food, must necessarily be the retracting stroke. Huxley gives a vivid description of the action of the radula in general, comparing this action to that of a chain-saw. The muscles attached to either end of the radula cause it to travel backwards and forwards over the upper surface, and, with a sharp bend, under the lower surface of the forward end of the skeleton, forming a most effective instrument for rasping any substance with which the teeth are brought in contact. The only chain-saw with which I am acquainted, is a surgical instrument, consisting of a chain formed of links with rectangular transverse section, having teeth along one of the narrow edges, and a short, transverse handle at either end of the chain. In action the chain is passed around a bone, or similar object, with the teeth occupying the inner contour of the curve, and then by an alternate pull of the hands of the operator these teeth gradually sink themselves into the substance operated upon. But the chain-saw of *Sycotypus* has the teeth upon the outer contour of the curve, and, as the appropriate muscles cause the formidable weapon to travel over the end of the skeleton, we may well believe the statement of Stimpson, that "with a sudden jerk of the lingual ribbon, inward and sidelong, it can take a strip of flesh" from any unfortunate mollusk on which it may be feeding.

A METHOD OF PREPARING, FOR MICROSCOPICAL STUDY, THE RADULÆ OF SMALL SPECIES OF GASTEROPODA.

BY CHARLES E. BEECHER.

(*Read November* 18*th*, 1887.)

One of the early methods employed to obtain the lingual membranes of Gasteropoda, was by actual dissection. This process, in many cases, is very laborious and the results unsat-

isfactory. Advantage was next taken of the resistance of the radulæ to the action of ordinary chemical reagents. The resistance to acids and alkalies induced the early belief in the silicious composition of the teeth, and it is only quite recently that the fallacy has been eradicated from text books on natural history, and from special works on the mollusca. It is now known that the teeth are composed of a substance closely related to chitine. Its behavior under the influence of the ordinary staining fluids used in microscopical work, is quite varied and interesting, and affords some points of comparison with true chitine.

Another method, applied in the study of the extremely small radulæ of minute species of snails, was to crush the animal, and examine the dentition through the translucent tissues. Of course, this plan is in itself not altogether satisfactory, on account of the difficulty of distinctly studying the characters of the lingual membrane. Besides, it was not conducive to the production of clean, beautiful and permanent preparations, such as ought to be retained, to serve as the types from which descriptions and illustrations have been made, and from which important deductions have been drawn.

When the characters of the odontophore came to be studied, it was first thought that they would furnish a simple means of classification, and an infallible method of determination. At the present time, the best authorities have abandoned nearly all the classifications of the Gasteropoda based upon the characters of this member alone, and give to it an importance about equal in value to that of the shell. Thus it will be seen that the radula still holds an important position in the study of the mollusca, but is not of the greatest value.

Several of the steps indicated in the following directions for preparing the radulæ of the Odontophora, for microscopical study, and for permanent preservation, have been employed by previous investigators in this department of research; but it is believed that some novel features are here described, and the entire sequence of processes is reduced to a system, which will be found to produce uniform and satisfactory results. At first, I adopted the methods in common use, and found that for the work which I had undertaken, namely, the study of the lingual dentitions of the American fresh-water species of *Rissoidæ*, I

could not attain the desired degree of excellence in the preparation of the radulæ, which would enable me to make a complete study of their various features. This led to a long series of experiments, performed with all the principal reagents used in microscopical investigation. An enumeration of these experiments would add but little to our knowledge, beyond the fact that most reagents are useless for this work, and many are of but little value.

When manipulating with such small objects as the lingual ribbons of our *Rissoidæ*, small species of *Planorbis*, *Goniobasis*, *Pupa*, *Vertigo*, etc., simplicity is of the greatest moment, for in transferring the radula from one dish to another, and passing it through successive reagents, it is very likely to be lost, or so mutilated in handling as to be worthless. Therefore, a complicated or laborious method is to be avoided if possible.

The transparency of the objects is also another obstacle to be overcome, and while mounting media can be selected of a different refractive index, yet the loss of absolute and reliable differentiation, from the reflection of light from the polished denticles, the interference of perspective in media of low refractive indices, and the diffraction lines produced by the minute denticles, render it extremely desirable to stain the specimens, and to mount them in a highly refractive medium, or one that nearly agrees with the refraction of the objects themselves.

Method of Preparation.—The shells having first been boiled or placed in alcohol to kill the organisms, the animals are extracted from their shells by drawing them out with a mounted needle or hook, and in the larger species the head is cut off, and the remainder of the animal rejected. In the minute species, the shell may be removed by hydrochloric acid. Either process may be employed, to equal advantage, upon shells which contain the dried remains of the animals.

The specimens are then placed in a small porcelain crucible containing water, in a sand bath over a Bunsen burner. A little boiling will soon render them in a condition for the rapid action of a small piece of caustic potash, which is next placed in the crucible, and the whole allowed to boil until the tissues have become disintegrated and partially combined with the potash. The action of the potash should not be continued after it has completed its work upon the tissues, as continued boiling will

attack the thin membrane, upon which are situated the lingual teeth, and which holds them in position.

After removal from the burner, water is added and the undissolved material allowed to precipitate. With a pipette having a rubber bulb, or by decanting, the fluid is nearly all removed, and clean water again added. This is repeated, until the potash and light flocculent matter are eliminated.

The residue is then washed into a flat-bottomed dish, or large watch crystal, and the radulæ, in the majority of cases, can be perceived by the unassisted eye, and removed, by means of fine, mounted needles, to another receptacle containing a very small amount of water. In case the radulæ are very small, the material is transferred drop by drop, with a pipette, and examined, under a one inch or three-quarter inch objective, on the horizontal stage of a microscope, preferably furnished with an erector. They can then be removed from the mass of extraneous matter, and placed in a separate receptacle, as in the former instance.

A drop of strong chromic acid is added to the specimens, and in from one to two minutes the teeth on the radulæ are stained a light yellow or amber color. After washing out the chromic acid, the specimens are dehydrated in the usual way, and after removing the acohol with a pipette, absorbent paper, and partial evaporation, oil of cloves is added, and the specimens are ready for mounting in Canada balsam.

The lingual membranes will be found to be more or less coiled, and usually attached to the jaws. It is desirable, in the mounted specimen, to have the membrane flattened out, with the dentiferous side uppermost, and dissociated from the jaw. Some species have a large strong jaw, which, if left with the lingual membrane, will raise the cover glass so far above the denticles as to exclude the use of the higher powers of the microscope. Therefore, some mechanical work is necessary to unfold the radula, and remove the jaw. Having provided a clean glass slide on the turn-table, the specimen is taken from the clove oil and centered on the slide. Now placed under the microscope provided with an erector, and using mounted needles, the radula is easily unrolled with the dentiferous side uppermost and the jaw removed. Replaced upon the turn-table, a thin cover-glass is superimposed and centered. The cover-

glass should be put on before the balsam is added as it prevents the specimen from again becoming coiled or displaced. A drop of balsam in benzole is put adjacent to the edge of the cover, and the slide held an instant over a gas burner or alcohol lamp, which will cause the balsam to flow by capillarity under the cover-glass. A small spring-clip is then used to press the cover down and hold it in place. The slide is removed to a drying oven, and left until the balsam has hardened, so that the portion outside the cover can be scraped off. The slide is then cleaned by washing in strong alcohol, using a piece of soft tissue paper to rub it dry. It is quite essential to use cover-glasses of known thickness. Many radulæ require a one-tenth inch objective. The convexity of the object combined with the thickness of the cover, necessitates the use of very thin glass. For the *Rissoidæ*, I have usually employed glass of .004 inch thickness.

The finishing and labelling of the slide are matters of individual taste, and are not requisite to the success of the preparation, except that the cover must not be piled high with varnishes and cements, which will interfere with the use of high magnifying powers. My usual method is to run a small ring of shellac around the edge of the cover, and, in case of bad centering, or other slight defects of mounting and cleaning, or often for pure ornament, to add colored rings with a very fine brush. The colored varnishes are composed of the best tube oil colors, dissolved in chloroform and reduced with balsam in benzole These colors are translucent, permanent and ornamental.

The advantage of using an erector, for delicate manipulations under the microscope, cannot be overestimated, as the best success can thus easily be obtained. We may learn to use one hand in reversed movement, but it is almost impossible to govern both hands, so that these delicate objects may be safely handled.

Some good preparations were obtained by substituting nitrate of silver for the chromic acid, as a staining reagent; but the specimens require boiling in the silver solution, and this additional step further complicates the process, and makes it less possible to retain small specimens. Besides, too much action of the silver renders the objects opaque.

In conclusion, I may say that with rare and minute species of shells, the entire sequence of steps, in the preparation of the radula, may be performed upon the slide, with the assurance that the object cannot easily escape.

CHOLERA ASIATICA.

BY WILLIAM H. BATES, M. D.

(*Read October 21st*, 1887.)

The name chosen to designate this disease was extremely inappropriate, having been used since the days of Hippocrates for a complaint attended with a flux of bile—Χολή. Whereas the Indian disease was marked by an absence of bile in the matters vomited, or discharged from the bowels. For a time, therefore, there was much confusion, and the epithets "Asiatic," "epidemic" and "malignant" were commonly applied to the new malady, by way of distinction from the former affection.

In the winter of 1817–'18 there appeared in the camp of the Marquis of Hastings, then engaged in the Mahratta war, on the banks of the Sind, a very fatal malady, attended with vomiting and purging. It is now believed to have prevailed in India from time to time during the previous century, and indeed as far back as history goes. But it was then taken for a new disease, and created the utmost terror. During the next few years it spread over a large part of Asia, in the following order: In 1818 in Burmah, Arracan and Mallacca; 1819 in Penang, Sumatra, Siam, Ceylon and the Mauritius; 1820 in Tonquin China and China; 1822–'23–'24 in all China; and in 1827 in Chinese Tartary. Turning to the West, we find it in July, 1821, at Muscat and the Persian Gulf; in 1823–'29–'30 in Persia; and in 1823 in Astrachan, without spreading further westward for some time, *i. e.* until 1829, when it made its appearance at Orenburgh through Tartary, revisited Astrachan in 1830, and then started on its course through Europe. It continued slowly westward, and in May, 1831, it was severe at Moscow and Warsaw; and in July of the same year at St. Petersburgh and Cronstadt; and in October at Berlin and Vienna. The first cases in England appeared at Sunderland in October, 1831. This fatal malady ravaged the whole of Europe, and left that quarter of the globe in 1837, the last place affected being Rome. In 1832 it crossed the Atlantic and reached Quebec, and extended over the United States. Besides the first great epidemic above mentioned, the western parts of the world have suffered from two severe visitations of Cholera, viz., in 1848–'49 and in 1853–'54. In 1866 Europe and America were again visited, and in

1868 it was very severe in South America. In 1872, and again in 1873-'74 it was destructive in Hungary, Poland and Prussia. In 1873 it caused great mortality in several towns in theMississippi valley. Yokohama, Japan, and Canton, China, were severely visited in 1877. Cholera seems to have spread East, South, West and North from its birth-place in Bengal, which became but the centre of an epidemic area, comprising nearly all the world. It travelled slowly at first, and not continuously, but in irregular waves—checked sometimes, but not destroyed by winter's cold. Neither climate, nor season, nor earth, nor ocean seem to have arrested its course, or altered its features. It was equally destructive at St. Petersburgh and Moscow, as it was in India ; as fierce and irresistable amongst the snows of Russia as in the sunburned regions of India ; as destructive in the vapory districts of Burmah as in the parched provinces of Hindostan.

The onset of this malady may be gradual or sudden. After exposure to the exciting cause of the disease, there is a period of incubation, which is believed to be generally two or three days, but sometimes not more than twelve or twenty-four hours. Dr. Goodeor, in Reynold's System of Medicine, cites an instance, recorded by Dr. Barry, in which a detachment of Sepoys, on their march from one place, free from Cholera, to another passed through a village where it was raging. One of the Sepoys was attacked after forty hours, and fresh cases appeared subsequently.

When the disease sets in gradually the earliest symptom is generally diarrhœa, which is often called "premonitory," and which may be attended with a sense of exhaustion. In some cases occur depression of spirits, malaise, headache, vertigo, noises in the ears and oppression of the epigastrium. The countenance of a patient during the premonitory stage is often pallid, anxious, and sorrowful. Cases have been cited where the approach of Cholera has been suspected mainly from the aspect of the patient, hours before the characteristic symptoms appeared. The premonitory stage may last from a few hours to two or three days. In many instances it is altogether absent. In more than half the cases it is said to begin in the early morning, perhaps waking the patient up from sleep. It sets in with violent purging. The contents of the bowels are rapidly swept

out in a fluid form, and the discharges soon become almost colorless, like whey, or like water, in which rice has been boiled ; so that they are commonly spoken of as "rice-water" evacuations. On standing, this fluid deposits a loose, whitish gray material, which consists of mucous flocculi, containing numerous leucocytes, and immense numbers of granules, including many bacteria. This flow is sometimes most profuse. The specific gravity of this liquid is 1.006 to 1.013. It has a neutral or slightly alkaline reaction, and contains chiefly sodium chloride with a quantity of albumen. So profuse is the flow that several pints or quarts may be voided in a few hours. When collected in a vessel it may be of a light yellowish color at first, owing to a slight admixture of bile. Sometimes a pinkish tinge is caused by the admixture of blood. Often there is no pain in the bowels, but sometimes patients complain of griping pains in the abdomen. After an interval vomiting sets in. The fluid rejected from the stomach, unless mixed with food, is pale and watery, being identical with the "rice-water" liquid. There are also crampings of the muscles of the feet and calves of the legs, and sometimes cramps of the thighs, hands, chest and abdomen are among the early symptoms. In many cases they may be absent.

These symptoms are usually followed, more or less rapidly, by the development of a very remarkable condition known as "collapse," sometimes described by some writers as the "algid stage" of the disease. It usually occurs within six or seven hours after the commencement of the purging, and often earlier. Occasionally the patient dies collapsed, before there has been any evacuation, the rice-water being found in the intestines after death. This collapsed condition is due to the failure of the circulation, beginning at the periphery, but afterwards affecting parts nearer the heart. The pulse at the wrist becomes more and more feeble and thread-like, until it is altogether imperceptible. This condition of collapse frequently leads directly to a fatal termination, which usually takes place between twelve and twenty-four hours after the commencement of the attack ; but sometimes earlier, and sometimes during the second day. Reaction not infrequently, where collapse in extreme form has existed, takes place in from twenty-four to forty-eight hours. Improvement occurs slowly.

Regarding the cause of Cholera much has been learned during

the last fifty years. It may be taken as an established fact, that its diffusion over the world from India results from human intercourse. During its first entry into Russia, and its spread through northern Europe in a north-westerly direction, it was supposed by many physicians to owe its dissemination to some mysterious atmospheric, or telluric agent. But its slow and halting progress rendered such a view improbable. A remarkable circumstance regarding Cholera is, that although it has spread to almost every part of the world, and has sometimes prevailed under widely different thermometric and other conditions, it seems to be capable of establishing itself permanently only in India, and in a particular region of that country.

With regard to the mode of diffusion of Cholera, it but seldom passes from a sick person to one who nurses him. It is believed, and I might say pretty conclusively demonstrated, that the contagion of Cholera escapes with the rice-water evacuations, and these are believed to be only infective at a certain stage of their decomposition, and not when fresh. Evidence in support of this view resulted from the experiments made by Thiersch and Sanderson. In experiments on mice by Sanderson, with the liquid one day old, 11 per cent. of them died ; two days old, 36 per cent. died ; three days old, 100 per cent. ; four days old, 71 per cent.; five days old, 40 per cent.; and at six days old, it became innocuous again. The morbid appearance, found in mice after death, appeared to be consistent with the view that death resulted from Cholera.

Regarding the more recent views, and the discovery of the Comma Bacillus by Koch, which is usually found in the evacuations, I will say nothing. The gentlemen, who present their views this evening, will exhibit and explain the peculiarities and mode of growth distinguishing it from other forms similar in appearance.

NEUROSIS OF CHOLERA.

BY L. SCHÖNEY, M. D.

(*Read October 21st*, 1887.)

One of the ingenious theories propounded with regard to the cause of Cholera is that of Dr. Chapman. We may call it the Neurotic Theory. Dr. Chapman ascribes Cholera to a dis-

turbance of the nerve centres. Diarrhœal discharges have been frequently claimed to have a purely neurotic origin.

It means an excessive activity in the spinal cord, and in the sympathetic nervous centres, combined with a superabundance of blood in these organs. Dr. Auzont, a French physician, says "Cholera is to the great sympathetic (nerve) what Epilepsy is to the brain. From pursuing the symptoms of different cases any unbiased observer must admit, that Cholera is to a large extent a disorder of the nervous system, notably the sympathetic."

Dr. Chapman's treatment consists of the spinal ice-bag. At the last meeting I mentioned another treatment, which reports enthusiastic success, and whose author is Dr. Peacan, of Buenos Ayres, S. A. He bases his treatment on the Neurotic Theory, and applies actual cautery to the condyle of the lower jaw, behind the right ear, with a view of *stimulating the pneumogastric nerve, and thus paralyzing the action of the sympathetic on the abdomen.*

Reconciliation of Theories of Cholera.—This Neurotic Theory is not adduced here merely to add something to the innumerable theories, all of which have a more microscopical origin and demonstration, while the Sympathetic Nerve Theory has only clinical results to show ; but for the sake of reconciling the vehement opposition and contradiction of the two schools—the German and the English schools—notably those of Koch and Klein.

To this end I propose the following compromise: Every one, who has lived in an epidemic, like Cholera, Typhus, Yellow Fever, or even Smallpox, has seen cases of a simulating character, caused by nervous shock. They may appear, or begin as imaginary at first, yet they become real—real in a symptomatic sense, real as a true nervous shock, real even in fatal result. I was in Paris in '67, during an endemic of Puerperal Fever in the lying-in ward of the Hotel Dieu. One morning, when we came in inquiring about a certain number in a ward, which were sick a few days before, we met the nurses in the court-yard of the Hospital in a frantic condition. "They are all dying," was their frightened report. Even those who were not sick a day before, and had no contact by nurses or otherwise with distant wards, had through nervous shocks been severely attacked with

fever, simulating in many symptoms Puerperal Fever. Some of these died ; while others really sick with specific puerperal poison, recovered. During epidemics of Smallpox even, I saw persons from mere fright not only become nervously shocked and highly fevered, but affected with a rash, which was of course of neurotic, or indigestive origin.

To be short : in Cholera epidemics thoroughly neurotic cases are not only not rare, but of a very intensive nature. There is a form which the French call, Cholera "foudroyant"—lightning-quick, or thunderstruck. It is a form, as you may infer from the term applied to it, acute—very acute, a very severe form. Now in these acute cases, Dr. Klein, of London, who is the chief opponent of Dr. Koch's Comma Bacillus theory, found no specific bacteria. But these, as we explained above,were indeed no specific cholera cases, but were mere neurotic cases, while the cholera patients, who developed the regular symptoms, never failed to reveal the commas in the intestines, after an honest search at the necropsy. In short there is a bacillous Cholera, and a non-bacillous, or neurotic Cholera. The bacillous, or genuine Cholera Asiatica is also to a great extent of neurotic character in its action. Yet the non-bacillous is merely one purely so—neurotic "kat exochen." There is an analogy to be found in Phthisis. There exists a bacillous and a non-bacillous Phthisis as Dr. Tradeau has shown. Perhaps also there is a dualism in Hay Fever.

To differentiate the three Comma Bacilli of Asiatic Cholera of Koch, Cholera nostras of Prior and Finkler, and the one discovered by Deneke in old cheese, which cannot be distinguished by the microscope, we must resort to the test by culture. They behave quite differently in their mode of growth. The pure culture of the germ of Asiatic Cholera, when planted in a test tube of gelatine, grows in the form of a funnel, but does not liquify the gelatine. It spreads in a granular mass. The Hog-Cholera germ liquifies slowly, and the Cheese bacillus liquifies rapidly the gelatine in which it is planted.

Another easier test is the chemical test discovered by Dr. Biejwid (Zeitschrift für Hygiene). If a five per cent. solution of hydrochloric acid is mixed with a bouillon of cholera germs, the mixture will turn rose-violet, and this color will intensify for half an hour, after which it will remain stationary.

THE COMMA BACILLUS, THE REPUTED CAUSE OF ASIATIC CHOLERA.

BY P. H. DUDLEY, C. E.

(*Read October 21st*, 1887.)

Dr. Billings, Surgeon General of the United States Army, in a Lecture before the New York Academy of Sciences, stated that the home of Asiatic Cholera was in the Delta of the Ganges, the home of Yellow Fever in the West Indies, and the home of the Plague in the Valley of the Euphrates. It seems to be a well-established fact, that Cholera breaking out in other territory can be traced back to its home as the origin of the epidemic, the germs having been carried by travellers on land or sea, and in many cases not by the persons, but in clothing packed in trunks, etc.

Koch, the discoverer of the Comma Bacillus, the reputed cause of Cholera, is reported as saying that "the germs are destroyed by drying." While this may be true of the Bacilli, when in the form of those shown in the unmounted photomicrograph, taken from a slide said to be from his Laboratory, it is doubtful whether the spores would be killed by drying. Probably some of the members have made culture slides of this Bacillus, and can answer the question.

It seems probable that the spores can be disseminated some distance by the air, as they are found in collected rain-water in India. How far this distance may be is of considerable interest, but it is hoped it is quite within the limits of Quarantine of this city.

What will destroy the germs is another question of great importance. For upon proper germicides largely depends the success of the efforts at Quarantine to prevent the ingress of the Cholera to this country. Does experience show that fuming clothing and vessels with sulphur effectually kills the germs? Must heat above 212° also be employed?

The Photomicrograph, showing the destruction of the mucous coat of the intestines, will be of interest. It is thought that a few Bacilli can be seen in this view.

THALLOPHYTES IN MEDICINAL SOLUTIONS.*

BY ROBERT G. ECCLES, M. D.

(*Read before "The Medical Microscopical Society of Brooklyn," N. Y., October 5th,* 1887.)

Most educated Pharmacists are aware of the fact, that aqueous supplies of medicine are subject to pollution during warm weather, even if prepared with, what is ordinarily considered, scrupulous care as to cleanliness. Unidentified forms of cryptogamous vegetation develop therein from spores, which the air, water, drug or vessel supplies. Finding proper conditions for development, they soon form slimy, stringy masses of what is no doubt the mycelium of plants, which on more solid support would fructify aerially. Soda water and ginger ale dealers have the same pests to contend with. Technically they speak of their beverages as "ropy" when so infected. Among the branching masses are usually found great numbers of motile bacteria and micrococci.

It is now becoming a pretty well understood fact that these lower forms of life protrude their unwelcome presence wherever anything can be found for them to live upon. No longer is civilized man compelled to contend with wild beasts for the mastery of the earth. Lions, tigers, wolves and hyenas are almost entirely suppressed. Guns and bows now give place to microscopes and culture tubes, as we hunt up foes our fathers knew not. They were then even more subject to attack from this quarter than we are, but fancied they had to deal with demons, or visitations of heaven for their sinfulness. We can still truthfully say, however, that their name is legion.

These lowly organisms wage incessant war upon our foods, beverages, and medicines, and as is now well known spare not even our bodies. Butchers, bakers, millers, grocers, fish-men, farmers, fruit-dealers and gardeners all have to fight them. To their presence is due all kinds of sickening deteriorations and decompositions. Their approach to omnipresence has given rise to the canning of milk, meat, fish and vegetables, and to the keeping and transportation of such goods by refrigeration. They wage incessant and relentless war against biological weak-

* For the illustrations of this article we are indebted to the courtesy of the Editor of the *Pharmaceutical Record.*

ness. As soon as vitality is diminished in an organized body their hungry attack begins.

If they were all of a kind, or even of but a few kinds, we might hope to exterminate, or fully control them. Their habits, appearances, and powers vary so widely that their study is almost hopelessly complex. Even their classification is a matter of dispute and doubt. Some of them are so unlike either plants or animals, that the proposal has been made to give them a sub-kingdom of their own. They have been referred to as fungi and algæ, but the lines run so confusedly into each other, that this method of distinction is being abandoned for that of Sachs, which includes the whole debatable ground under the name, Thallophytes.

The number of known Thallophytes, formerly included under the title, fungi, rises up among the hundreds of thousands. Many of them pass through successive changes in their life history, which at various stages give such diverse characteristics, that the most careful investigators are baffled in attempting to find their place in nature. Two Mycologists, viewing the same genera, species, or even varieties, in different stages, may give them totally different names, as well as descriptions, and put them in families exceedingly remote. It will probably be a long time before this trouble is obviated.

Of the forms that infect our medical supplies, no less than thirty different kinds are found in the solutions presented here to-night. It is quite probable that an increase in the number of samples would add materially to the number of kinds that could be discovered.

Exhibit 1., under the first microscope, is a sample of infected dilute Phosphoric Acid (Fig. 1). The engraving represents one view of this object. The long, branching, obscurely jointed stems constitute the most conspicuous thing in sight. A closer inspection will reveal numerous minute motile specks, and little rod-like masses squirming and twisting, like the larvæ of flies in a piece of spoiled meat. The very minute bodies are living micrococci, and the somewhat larger ones are innominate bacteria. Some of them are probably *Bacterium termo.* It is unusual to see these minute plant-forms in their active state. Generally such exhibits are of dead, stained forms. What adds greater interest to these is the fact, that every slide before us to-night is

a closed cell, where they have been hermetically sealed for two years and three months. In spite of their long confinement they are yet alive, but their movements are not as quick as when first mounted.

When first mounted, and in fresh specimens generally, what are apparently transition forms, between the bacteria and the jointed mycelium, can be found. These led your essayist to believe that the latter were spores, from which the former developed. Prof. Farlow, the Mycologist of Harvard University, thought this must be a mistake, when told of it. That these

FIG. 1.—From Dilute Phosphoric Acid.

transition forms are there is certain, but that the smaller masses are veritable bacteria may be doubtful. Polymorphism is a well-known fact among Thallophytes, but to trace direct relationship between gutter-bacteria and higher fungi would indeed be startling. When some of the threads were transplanted to moist bread under a bell glass, a crop of *Pencillium glaucum* appeared. Other solutions, having growths differing markedly in appearance from those of dilute Phosphoric Acid, when transplanted in a similar manner, gave a variety of *Pencilliums*,

Mucors, *Zasmidiums*, etc. These may have been sown during transplantation, or have pre-existed as spores in the bread. That they appeared, and that a repetition of the experiment gave nearly the same results, made it look as if an actual kinship existed between the aerial growth and fructification, and the subaqueous threads.

From the Orange-Flower Water specimen, no growth on the bread resembled in the least the spiral structure shown in the

Fig. 2.—From Orange-Flower Water.

drawing (Fig. 2). Prof. Farlow thought it might be a parasite, known to exist in southern forests. A large variety of strange forms can usually be found in this water. The writer has never seen a specimen free from them.

The most interesting specimen to watch is that from a solution of Strychnine (Fig. 3). The peculiar, swollen appearance of the joints at various places, and the motile protoplasm they contain, either as their own spores or attacking parasites, make them well worth studying. This drawing, as well as most of the others, was executed by following the branches, while lowering and raising the objective to suit the sight. In this

way every dip is traced upon the level surface. The minute motile masses appear to the eye as if endowed with independent will. Now they are spinning like a top with only the tips visible, and again writhing like a serpent at full length. Like caged animals, they run from end to end of the imprisoning sheath, and sometimes roll over and over each other, like boys playing a game of leap-frog. The sheath is like the segment of a joint-rush, with a septum at each end, but having transparent walls.

In Orange-Flower Water we find living spirilla that are like-

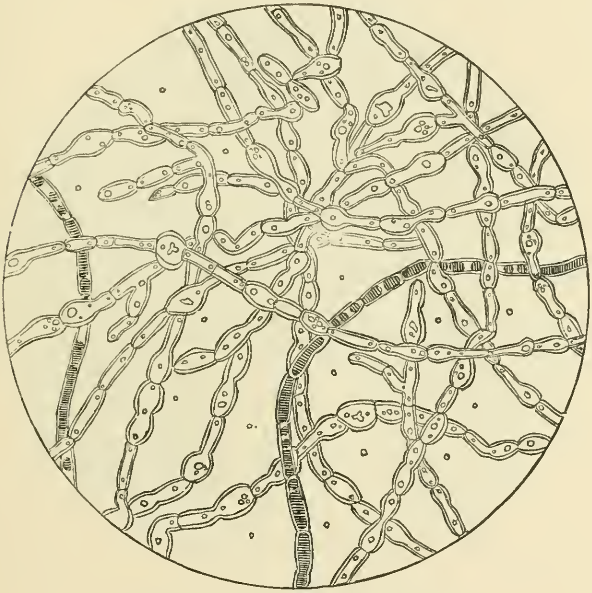

FIG. 3.—From Sulphate of Strychnia.

wise motile at the proper season. When death overtakes them they look like Koch's Comma bacilli.

In Cinnamon-Water only bacterial forms have yet been seen, and these evidently decompose the essential oil. As they increase the water weakens, and cinnamonic acid crystals appear.

In Sulpho-Cyanate of Potassium (Fig. 4), Carbonate of Barium and Phosphate of Sodium organisms containing Chloro-

phyll appear. At first they are very like Micrococci, and appear in chains. Finally some of them enlarge, and develop a distinct nucleus containing the green color. By the old method of classification these would have been Fungi if seen young, and Algæ in old age. Now we make them Thallophytes in either condition.

In solutions of the Salts of Morphia (Fig. 5) the long stringy masses that invade other solutions of alkaloidal salts seldom, if ever, appear. After a successive series of trials, only motile bacteria and innominate bacilli have been developed. Coinci-

Fig. 4.—From Sulpho-Cyanate of Potassium.

dent with their appearance, a crystalline precipitate is found at the bottom of the containing vessel. This has not yet been examined chemically. Its brownish hue would seem to indicate that some sort of decomposition had occurred. The claim was put forth about a year ago that Apomorphia appeared under such circumstances, where only a salt of Morphia had been before. Patients are said to have acted as if an emetic had been swallowed, on the administration of old specimens. An

English chemist got negative results, on examining an old sample a few months ago.

The reason, why tinctures containing alcohol, and fluid extracts containing glycerine, took so largely the place of infusions and decoctions, probably resides in the fact, that alcohol and glycerine are antiseptic, and protect for an indefinite period their solutions from infection. A number of proprietary syrups, and so-called fluid extracts, prepared by men badly posted in pharmacy, cannot be kept long when the bottle is open. Doctors often order these in their prescriptions. If you are among

Fig. 5.—From Muriate of Morphia.

those who do so, and you find them bacteria-laden and mouldy, blame yourself only. Elixirs, like wines and tinctures, contain enough alcohol to protect them against these growths. With solutions of alkaloids and their salts, other methods of protection must be resorted to, or they must be prepared in small quantities, and as needed. Camphor-Water, Chloral, Corrosive Sublimate, Salicylic Acid, Boric Acid and Benzoic Acid are a few of the antiseptics now used. The two last are probably the best, all things considered. Such alkaloids as Strychnine and

Morphine, that will not decompose at a low temperature, can be sterilized in solution, by raising to the boiling point and securely corking. In this way they will keep for years.

The hygienic considerations connected with this subject are of the first importance to us as medical men. Can it be conducive to health to swallow any of these, whatever their name, shape or order? It is positively known that *Mistura Creta*, prepared from decomposed Cinnamon-Water, has made cases of summer complaint in children worse, and induced emesis at every dose. The *London Lancet* (Jan. 29th, 1885, p. 224.) showed that solutions containing such growths, irritated and eroded mucous membranes to which they were applied. The Mucors have been found in the stomachs of dogs in full fruition, in spite of the presence of gastric juice. They grew and flourished there embedded in its walls. Almost every tissue of birds and beasts have been found infested with them. Sternberg, in his work on Bacteria, p. 293, gives a drawing of a growth from the fauces of patients suffering with Anginal Scarlatina, that is exceedingly like some of these we are studying to-night. Hypodermic injections of solutions of alkaloids often produce bad abscesses in an unaccountable manner. After investigation clears up the trouble, by showing the solutions to be infected with these plants. Too much care cannot be taken in seeing to the purity and cleanliness of the drugs we prescribe. Probably half the druggists of the country never notice these changes in their solutions, or suppose them to be mere precipitates of the active agents, and therefore harmless. Very few of them indeed know that wriggling, twining maggot-like bodies are there, the thought of swallowing which is enough to turn one's stomach, even if they did not physically act as emetics. Until they are taught these facts no effort at improvement can be so much as hoped for. Some of them even melt ice, and use it as distilled water, to put up such solutions with, and we all know, that our supply of ice from the Hudson is contaminated with the sewerage of Albany and Troy, containing typhoid fever germs. Our bodies may have strength enough to resist the small number of these, introduced from a glass of ice-water, but when druggists deliberately use our medical supplies as culture fluids, who knows when they may raise the number so high, that the disease is given to patients with minor affections?

The question as to whether these growths act as ferments, and decompose the solutions in which they are found, has been raised. Those that develop in such solutions, as Barium Carbonate, Phosphoric Acid, Boric Acid and Zinc Sulphate, cannot possible act on these salts. Experiments show that, after standing for many months, diluted Phosphoric Acid loses none of its strength. The same is the case with Solution of Strychnia Sulphate. Other alkaloids that have been tried show a decrease in quantity, but they are such as are likely to decompose spontaneously, like Eserine, Morphine, Atropine and Cocaine. Old solutions of Sodium Phosphate ($HNa_2 PO_4$) containing algæ give off oxygen gas; whether by decomposition of the salt, or of carbonic acid has not been determined. Those that do not live upon the dissolved salts must depend for sustenance upon carbonic acid, absorbed from the air. Several trials, made to determine this point, all gave a common result. Vials, containing spores and aqueous solutions, being weighed, with duplicates having the same solutions sterilized, were found to steadily gain in weight over the sterilized ones, as the plants grew larger. They would not grow if hermetically sealed, and grew most vigorously when often exposed to the air by removal of the stoppers.

The bacteria no doubt act as ferments, but the larger growths of stringy, jointed organisms probably have some means of decomposing carbonic acid, as higher plants do. This is, of course, contrary to the generally accepted doctrine, that makes them either parasites or saprophytes, and denies them this ability. If fungi are the primitive forms of plant life, surely at some time in their career they all must have been carbonic acid decomposers. In the early genesis of things, they could neither have been parasites nor saprophytes, unless upon each other, and then some of them evidently decomposed carbonic acid. It is irrational and improbable to suppose that they would all lose even the power of reversion to their primitive state. No one has ever experimentally demonstrated that they do not decompose this gas. The distinction is only traditional. Fermenting fungi doubtlessly do, like animals, exhale vast quantities of carbonic acid. But all plants exhale some. Does this prove that they never decompose this gas and release oxygen? Further examination of this subject is needed, and

we venture to assert that present notions will be modified, if not revolutionized, when it is done. The earliest synthetic, organic chemists of our globe have not lost all their early knowledge, and developed totally into ignorant freebooters.

STRIATED MUSCLE-FIBRE OF THE HEAD OF HARPALUS CALIGINOSUS, FAB.

BY E. B. GROVE.

(*Read October 7th*, 1887.)

All at some time have noticed the extraordinary strength, out of all proportion to their size, possessed by insects of all genera, but especially by those which are classed with the coleoptera. Numbers of anecdotes and accounts of what has been witnessed of feats of strength can be found, not only in books treating of scientific subjects, but also, from time to time, in newspapers and periodicals not strictly scientific.

It may safely be said that at least two-thirds of these accounts have reference to the various feats performed by insects, walking under and moving heavy weights, or in drawing the same. The remaining one-third is of feats performed by the mandibles, and can be explained by the wonderful muscular system seated in the head.

From time immemorial the strength of the mandibles of the *Lucanus cervus*, the European stag-beetle, has been commented upon by all naturalists. There is an authentic account of one having gnawed or rasped a hole one inch in diameter through the side of an iron canister in which it was imprisoned. And our American species of the *Lucanus*, also, will at least speedily free itself from any pasteboard or thin wood box in which it is confined.

While making no pretence to being either a histologist or anatomist, I have always been interested in the economic anatomy of all insects, especially of their digestive and muscular systems. Many fine specimens of butterflies, moths and beetles have I ruthlessly "cut up," in the quest for knowledge as to their life and habits, rather than mount them and place them in my cabinet.

Muscles are structures of an elastic nature, which under the effect of certain irritations are capable of altering their form, *i.*

e., becoming shorter and thicker. In all vertebrates, but especially of the higher orders, they constitute the mass that is called flesh. They are covered by tendinous sheaths, and are united by the so-called connective tissue. But in insects the fibres are not so united. They are deficient in the tendinous sheaths, and are attached directly to the cutaneous exo-skeleton, as in the crustacean.

These muscle-fibres are divided into two kinds—striated and smooth. The striated fibres are thus named because they are apparently streaked at right angles across the longitudinal direction of the fibre. And they may be compared, as viewed microscopically, to a roll of coin. It is a grave and unsettled question as to what these striations or streaks are. When fibres are treated with certain reagents, they separate along the lines of the striations into discs. Other reagents, on the contrary, cause them to split up longitudinally into still finer fibres. Dr. Rosenthal, in his work on "Muscles and Nerves," says: "It is impossible to affirm that either the discoid or fibrilloid structures actually exist in the muscle-fibre itself," and "it can be shown that the fibre, when taken from the living animal, is of a semi-fluid consistency, and it must rather be assumed that both forms of structure are really the results of the application of the reagents, that solidify the semi-fluid mass, and split it up in a longitudinal or transverse direction."

These striated muscle-fibres, in all animal life, are acted upon directly through the nervous system by the will, and for this reason are called the voluntary muscles. The smooth muscle-fibres, on the contrary, are not so acted upon, and are termed the involuntary muscles. There is but one exception to this rule. The heart is provided with striated muscle-fibres, and yet works independently of the will. Smooth muscle-fibres contract by local irritation, produced by certain matter in the organs which they surround, or of which they form a component part.

Wagner states that the muscular system of insects consists of distinct, isolated, straight fibres, which are not gathered into bundles, nor united by common tendons, and are *often* striated. Siebold, on the contrary, states that not only the voluntary muscles are striated, but often those of the organic life—*i. e.*, the involuntary muscles of the digestive organs—are striated.

Upon dissection of a beetle, either in its larval or perfect form, it will be found that the muscular system is most complex in the head. This is rendered necessary by the work demanded of the head-organs, especially the mandibles. *Harpalus caliginosus*, which I have selected as a type, belongs to the *Carabidæ*, or carnivorous beetles, and, like all of its family, renders great service to mankind by feeding upon other insects, which are injurious to vegetation. It is one of our most common American species, and may be seen, in company with the more gaudily-colored *Calosomæ*, busily engaged in hunting for its prey. And although not so attractive to the eye as the others, it is fully as destructive to insect life. Woe betide any insect that comes within the range of its eyes. From the soft-bodied Aphis to the almost metallic-coated Buprestian, all is "fish" that comes to its net, in either larval or perfect form. Its larva is equally as destructive. I have seen a female *Harpalus* seize a *Buprestis*—the *Chrysobothris Harrisii*, the body-crust of which is hard enough to turn the edge of the best scalpel made—and rend it to pieces with its mandibles, in a shorter time than I have taken in the description.

By examining the inner surface and contents of the head, it can readily be seen from what source the immense strength possessed by the mandibles is obtained. Almost the whole contents of that portion of the body consist of muscle-fibres, acting directly upon its organs. A look at the hurriedly-prepared dissection of the head of one of these beetles, which is here on exhibition, will show this fact. Everything but the muscle-fibres has been removed, and only the large flat or round fibres remain. Several of these at their front ends form their connections with the mouth appendages, but still connect with the head by their rear ends. It can be seen that they are arranged in various layers, or, as Newport calls them, *systems*. Lyonnet counted in the head of the *Cossus* some 228 distinct muscles. I have not counted those in the head of *Harpalus*, but should judge that they were fully as many. This number seems almost incredible. Yet, when we consider the various appendages of the head which are dependent upon these muscles for their various movements, it is not so wonderful. The movements of the antennæ, of the mandibles, of the various other parts of the

mouth and tongue, and also of the head itself, are produced by these muscles.

These striated muscle-fibres, when dissected out, as may be seen in the other slide on exhibition, consist, as stated before, of fibres that are streaked or striated across their length. They seem to be more strongly and coarsely marked than the corresponding muscles in man. A slide of human striated fibre is on the table, and can be compared with that of the *Harpalus*, and the difference will be noticed.

The commonly-accepted theory has been that the striated muscle-fibres of insects are not rounded at the ends, as they are in the vertebrates. But you will notice in the slide under the microscope, that a number of the *round* fibres have perfectly-rounded ends.

The contractile powers of the striated muscle-fibres in vertebrates have been minutely and carefully studied and described by many eminent histologists and biologists, of both this country and Europe. But little has been done in the way of study or description of these movements in insects. There is a wide field open for such investigations to any who may possess the necessarily-required time and patience. It certainly would be well worth the time spent to ascertain, if possible, by careful dissections and microscopical examinations, whether the nerves enter directly into the muscles, as in the vertebrates, and produce their excitation, and the consequent shortening in length, by a direct so-called nervous-electric shock; or whether they surround the muscle-fibres, and produce the result by a species of induced, or secondary current.

These striated muscle-fibres are of two kinds—flat and round. I have not as yet been able to find the pyramidal fibres, mentioned by anatomists, in the head. These muscles are arranged in layers. Newport and others call each layer a separate system. But there is not as yet any definite opinion on that point, and it can only be settled after long and patient study and examination.

The head muscles are stronger, less easily separated, and of a whiter color than those in other parts of the insect body. And I think it will be found that in the various carnivorous beetles, and their larva, that the fibres are larger than in other beetles.

In closing I would state that in dissecting insects, to reach

any certain results, such dissections must be made as soon as possible after their death, because the character of the internal organs, especially of the muscle and nerve-fibres, changes very quickly when the life is extinct. The best plan is to bring the insect home alive, kill it in the cyanide bottle, and dissect it immediately.

The slides here exhibited were made, unfortunately, from beetles that had been dead some three days before I could get the time to work upon them. Consequently the preparations do not present the same appearance that they would have, were they made from insects recently killed. They are simple laboratory mounts, and are not finished, nor are they intended for the cabinet.

Correction of the Article, "Raising Diatoms in the Laboratory."—The following correction of a slight error in the Article, "Raising Diatoms in the Laboratory," published in this Journal, Vol. II., p. 153, has been received from Dr. Lockwood:

"There is a little discrepancy in my Paper on 'Raising Diatoms in the Laboratory,' read before the New-York Microscopical Society, December 17th, 1886, and published in the Journal of the same. Referring, on page 7, to the first series of experiments, they are made to extend 'a little over two years.' This should read, 'a little over one year.' The actual time was nearly fourteen months, as the context plainly shows."—S. Lockwood, Freehold, N. J., October 18th, 1887.

SUPPLEMENT I. TO THE BIBLIOGRAPHY OF THE FORAMINIFERA, RECENT AND FOSSIL, INCLUDING EOZOON AND RECEPTACULITES.

(PRINTED IN THE FOURTEENTH ANNUAL REPORT OF THE GEOGRAPHICAL AND NATURAL HISTORY SURVEY OF MINNESOTA, pp. 167-311, 1885.)

BY ANTHONY WOODWARD.

(*Received October 26th*, 1887.)

EOZOON.

ANON. On *Eozoon canadense;* by Prof. Wm. King, S. C. D., and T. H. Rowney, Ph. D. *Amer. Journ. Sci.*, ser. 3, vol. i, pp. 138–142, 1871.

ANON. On the Geological Age and Microscopic Structure of the Serpentine Marble or Ophite of Skye; by Professors W. King and T. H. Rowney (Proc. Roy. Irish Acad., Jan. 1871). On the Mineral Origin of the so-called "Eozoon Canadense," by same (Ib., Apr. 10, 1871). *Amer. Journ. Sci.*, ser. 3, vol. ii, pp. 211–215, 1871.

ANON. The Eozoon Question—An American Mistake. *Month. Micro. Journ.*, vol. xiii, p. 244, 1875.

ARBEITEN der geologischen section der Landesdwichforschung in Böhmen, Prag, 1869.

BAILY (MR.) expresses his doubt that "Eozoon," "the thing in question, was a fossil at all." *Journ. Geol. Soc. Dublin*, vol. i, n. s., 1865.

BAILY, W. H. The Cambrian Rocks of the British Islands. *Geol. Mag.*, vol. ii, p. 388, 1865.

BONNEY, T. G. On Serpentine and Associated Rocks of the Lizard District. *Quart. Journ. Geol. Soc.*, vol. xxxiii, pp. 884-924, 1876.

During the discussion which followed the reading of this memoir, and in answer to a question put by the President, the writer replied that "for his own part he believed in the organic nature of *Eozoon*." How this reply is to be reconciled with the following statement Prof. Bonney has lately made—"I have *never myself seen a serpentine which was not intrusive*" (Geol. Mag., Feb. 1881, p. 94)—is a puzzle to us, as it must be to eozoonists, considering that their doctrine is based on the sedimentary or "*aqueous* deposition" of "eozoonal" serpentines (see last citation). But is not eozoonism full of inconsistencies? (King and Rowney. An old chapter of the Geol. Rec., p. xliv, 1881.)

DAWSON, J. W. Origin and History of Life on our Planet. An Address before the Amer. Asso. Adv. Sci. (Detroit meeting), vol. xxiv, 1875. Reprint 26 pp., Montreal, 1875.

Remark on Eozoon.

DAWSON, J. W. On the Geological Relations and Mode of Preservation of *Eozoon canadense*. *Rep. Brit. Asso.*, liii, p. 494, 1884.

DAWSON, J. W. Notes on Eozoon canadense (abstract of a paper read before the British Association at Southport, 1883). The *Canadian Rec. of Sci.*, vol. i, pp, 58, 59, 1884.

DAWSON (SIR), J. W. Remarks on Eozoon, in his Presidential Address before the British Association for the Advancement of Science, Sept., 1886. *The Canadian Rec. Sci.*, vol. ii, pp. 201–228, 1886.

DE STEFANI, C. Sulle Serpentine Italiane. Estraite dagli *Atti del R. Istituto veneto di scienze, lettere ed arti*, vol. ii, ser. vi., (18 pp.), 1884.

DUNCAN, P. M. Note on Eozoon canadense. *Journ. Roy. Micro. Soc.*, vol. iii, pp. 615, 616, 1883.

GRATACAP, L. P. The Eozoonal Rock of Manhattan Island. *Amer. Journ. Sci.*, ser. 3, vol. xxxiii, pp. 374–378, 7 woodcuts, 1887.

GÜMBEL, C. Geognostische Beschreibung des ostbayerisches, Grenzgebirges, 1868.

HAHN, O. Die Urzelle, nebst dem Beweis dass Granit, Gneiss, Serpentin, Talk, gewisse Sandsteine, auch Basalt, endlich Meteorstein und Meteoreisen aus pflanzen bestehen, 1879.

HARKNESS (PROF.), R. "*Eozoon*" having been brought under the notice of the Geological Section of the British Association, held in Birmingham of the year, Prof. R. Harkness declared his disbelief in it. "*Reader*," Sept. 30, 1865.

HARKNESS (PROF.), R. On the Metamorphic and Fossiliferous Rocks of the county of Galway. *Quart. Journ. Geol. Soc.*, vol. xxii, pp. 510, 511, 1866.

With reference to the occurrence of serpentine in connection with the limestones of the metamorphic series of Connemara, this has of late become a matter of some interest, in consequence of the statement that these deposits afford the *Eozoon Canadense*. . . . The supposed organic portions of the serpentinous limestones of Connemara do not result from animal structure, but purely from mineral association. Had fossils of

any kind presented themselves in this district, they ought to have occurred in that portion of the limestone which has been least affected by metamorphic action. (King and Rowney. An old chapter of the Geol. Rec., pp. xx, xxi, 1881.)

HEDDLE, M. T. The Geognosy and Mineralogy of Scotland. *Mineral Mag.*, vol. v, pp. 271–324, figs. 1–11, supports the view of the inorganic origin of the Scotch and Canadian Eozoon. (Zool. Rec., vol. xxi, 1884.) 1884.

HOFFMANN, R. *Eozoon* from Raspenau, in Bohemia. *Journ. für prakt. Chemie*, May, 1869.

An abstract is published in the "American Journal of Science," 3rd ser., vol. i, 1871. (King and Rowney. An old chapter of the Geol. Rec., p. xxii, 1881.)

HUNT, T. S. Note on Eozoon. *Bull. Essex Inst.*, vol. iii, pp. 53, 54, 1871.

HYATT, A. Remarks upon the Eozoon canadense. *Proc. Essex Inst.*, vol. v, p. 110, 1867.

HYATT, A. On the Geological Survey of Essex county. *Bull. Essex Inst.*, vol. iii, pp. 49-53, 1871.

Notes on Eozoon.

J. T. R. A notice of Möbius's Der Bau des Eozoon. *Ann., and Mag. Nat. Hist.*, ser. 5, vol. iii, pp. 314-316, 1879.

KINAHAM, G. H. *Nature*, vol. iii, p. 267, 1871.

The writer draws attention to the fact of its having been announced that Mr. Sandford had "proved the existence of *Eozoon*" in the ophites of Connemara, which, according to Sir R. I. Murchison and Prof. Harkness, are of Lower Silurian (Cambro-Silurian) age. "In other parts will be found square miles upon square miles of rocks of some geological age, often having inliers of limestone; yet in them there is no *Eozoon* Canadense, it only being found in a peculiar rock (pseudomorph dolomyte) in this small tract of Lower Silurian rocks, in Far-Connaught." (King and Rowney. An old chapter of the Geol. Rec., p. xxvii, 1881.)

KING, W. and T. H. ROWNEY. On the Geological Age and Microscopic Structure of the Serpentine Marble or Ophite of Skye. *Proc. Roy. Irish Acad.*, ser. 2, vol. i, pp. 137-139, 1871.

This rock, which is well known to be of Jurassic age, contains all the "*Eozoon*" features—"chamber-casts," "intermediate skeleton," "canal system" and "proper wall;" and, as in specimens from Canada, the "chamber-casts are occasionally preserved in, besides serpentine, a dark mineral resembling loganite, also white pyroxene or malacolite! This last mineral occurs in crystalloids which frequently exhibit themselves in a decreted condition internally and externally, the interspaces between them

and their hollowed-out interior being filled with calcite: this substance has clearly resulted from the carbacidization of the calci-magnesian silicate, malacolite. Some of the crystalloids are in shape strikingly resembling the "curiously curved canal system" of Gümbel's "*Eozoon Bavaricum.*" (King and Rowney. An old chapter of the Geol. Rec., p. xxviii, 1881.)

King, W., and T. H. Rowney. Remarks on "The Dawn of Life," by Dr. Dawson; to which is added a supplementary note. *Ann. and Mag. Nat. Hist.*, ser. 4, vol. xvii, pp. 360-377, 1876.

Dr. Dawson, in the work cited, replying to our statement that the laminated character of "*Eozoon*" is a mineralogical phenomenon (of which we had adduced instances), asserts that "the lamination is not like that of any rock, but a strictly limited and definite form, comparable with that of *Stromatopora*." We draw his attention to a specimen of granite from Harris (Hebrides) which consists of alternating laminæ of feldspar and quartz, the lamination being *strictly limited* and of *definite form*, and even far more "*Eozoon*" like in this respect than *Stromatopora concentricia*. The specimen was presented to us by our respected friend, the late Prof. R. Harkness. (King and Rowney. An old chapter of the Geol. Rec., p. xxxiv, 1881.)

King, W., and T. H. Rowney. On the Serpentinite of the Lizard, its original Rock-condition. Methylotic Phenomena, and Structural Simulations of Organisms. Phil. Mag., ser. 5, vol. i, pp. 280-293, 1876.

The rock in many places has undergone a change into saponite, and occasionally into calcite. The former contains bodies of various kinds, strikingly simulating minute corals, vemiform and foraminiferal organisms; the latter contains cylindrical forms and clusters of spherical bodies, resembling Dawson's "*Archæosphærinæ*," and branching configurations identical with the "canal system" of *Eozoon*. What appears to be tremolite contains spherical and other bodies wonderfully mimetic of perforated foraminifers, also rods, consisting of saponite, serpentine, flocculite, or calcite. The rods, especially those composed of the last mineral, throw some light on the origin of the "calcareous" examples of the "canal system" inasmuch as their component mineral carbonate is clearly the result of chemical alteration. The serpentine contains examples of chrysotile passing into the "nummuline" or pectinated condition. (King and Rowney. An old chapter of the Geol. Rec., xliii, 1881.)

King, W., and T. H. Rowney. On the Origin of the Mineral, Structural, and Chemical characters of Ophites and related Rocks. *Proc. Roy. Soc.*, No. 197. *Nature*, No. 544, 1879.

The present work is, to a great extent, based on the original memoir, of which the paper under notice is an "abstract." The latter notices the occurrence of "beautiful examples of 'canal system,' resulting from the

waste of crystalloids of malacolite, in the calcaire saccaroïde (hemithrene) of St. Philippe (Vosges), rivalling those in Canadian ophite."

When speaking of this hemithrene (pp. 51, 52) we omitted to mention that besides the "canal system," there are also present rounded grains or crystalloids of pyrosclerite (a serpentinous mineral), occasionally invested with an abestiform mineral related to, if not identical with, chrysotile; the investing fibres, usually in contact, are in many places separated by interpolations of calcite (pl. iii, figs. 2, 3), a fact proving them to correspond with those of the "proper wall" of Eozoon Canadense. (King and Rowney. An old chapter of the Geol. Rec., p. xlvii, 1881.)

King, W., and T. H. Rowney. An old chapter of the Geological Record with a new interpretation; or, Rock-Metamorphism (especially the methylosed kind) and its resultant imitations or organisms, with an introduction giving an annotated history of the controversy on the so-called "*Eozoon Canadense*," and an appendix, pp. i-lvii., 1-142; 4 woodcuts, 7 plates, 8°, London, 1881.

Kuntze, Otto. Zur *Eozoon-Frage*, 1879.

Anti-eozoonal.

Logan (Sir), W. E. The first announcement in connection with the subject of "*Eozoon*" was made by the Sir Wm. E. Logan, Director-General of the Geol. Survey of Canada, in his Report of the year, 1858.

Logan (Sir), Wm. E. Exhibited at the Meeting of the American Association for the Advancement of Science at Springfield, in August, 1859, some *Stromatopora*-like specimens (noticed in the above Report) from the Grand Calumet and Perth (Canada), which he was "disposed to look upon as fossils." Quart. Jour. Geol. Soc., vol. xxi, p. 48. (King and Rowney. An old chapter of the Geol. Rec., p. ix, 1881.)

Logan (Sir), W. E. Report of the Geology of Canada, 1863.

In this Report (pp. 48, 49) the discovery of specimens, supposed to be fossils, is noticed as having been made "by Mr. J. M'Mullen, of the Canada Geological Commission, in the crystalline limestone of the Grand Calumet river, Ottawa), which present parallel or apparently concentric layers, composed of crystalline pyroxene, while the interstices are filled with crystalline carbonate of lime. Dr. James Wilson, of Perth, found loose masses of limestone near the same place containing similar forms—the layers composed of dark green concretionary serpentine, while the interstices are filled with crystalline dolomite. If both are regarded as the results of unaided mineral arrangement, it would seem strange that identical forms should be derived from minerals of such different composi-

tion. If the specimens had been obtained from the altered rocks of the Lower Silurian series, there would have been little hesitation in pronouncing them to be fossils." (King and Rowney. An old chapter of the Geol. Rec., pp. ix, x, 1881.)

MACALISTER (DR.), A. President's Address. *Journ. Roy. Geol. Soc. Ireland*, new ser., vol. iii, p. 101, 1873.

A paragraph devoted to the "*Eozoon* controversy," and pronounced from the President's Chair of Royal Geological Society of Ireland, requires some little notice. Referring to some memoirs (not named), it is stated that they "occasioned a controversy which, if it did nothing else, turned some attention to the study of micro-petrography, and some at least of the writers displayed a very considerable practical ignorance not only of the appearance of sections of large foraminifera, but also of sections of common forms of rock and of the interpretation of rock-forms as seen by the microscope. With a larger experience of micro-petrography will come, I believe, a full conviction of the true organic nature of *Eozoon Canadense.*" It is now eight years since these remarks were made; and undeniably their author had taken considerable pains to master the bibliography of points connected with the subject-matter he touched upon; it is therefore to be assumed that Dr. Macalister still takes a deep interest therein, also that he is perfectly aware his "full conviction" has not yet been realized; hence we would urge on him to endeavour himself to bring about the outcome which he so confidently predicted in his "Address." (King and Rowney. An old chapter of the Geol. Rec., p. xxx, 1881.)

MOORE, C. On the Organic Nature of Eozoon Canadense. *Brit. Assoc. Meeting, Swansea*, pp. 582, 583, 1880.

"Possessed of only two slices, and two small blocks weighing but twelve ounces, both in their original condition," the writer detected in "separated twenty grains" belonging thereto "a clear siliceous-looking fibroid growth, scarcely more substantial than the motes or fibres seen floating in the sunbeam;" while "a close examination occasionally revealed another form not thicker than a spider's web, like mycelium growth of the present day," also what he takes to be "ova or gemmules" and a coloured filmy membrane, etc. We leave these evidences of organic structure to be appreciated by Eozoonists. (King and Rowney. An old chapter of the Geol. Rec., p. lii, 1881.)

NICHOLSON, H. A. Supposed Laurentian Fossil. *Ann., and Mag., Nat. Hist.* ser. 4, vol. xviii, p. 75, 1876.

A letter withdrawing the statement that the specimens noticed in his former letter "were essentially calcarious in their composition," as "upon investigation, the specimens proved to be composed of alternating layers of felspar and silica." The writer concludes with a remark by which he identifies himself with Dr. Carpenter in HIS *ipse dixit:*—"Whether the peculiar arrangement of the minerals which constitute these specimens can

be assigned wholly to the operation of inorganic causes or not, *is a question which does not in the meanwhile admit of solution !*"

We embrace the present opportunity to mention a few points connected with the Harris graphic granite. Fig. 1, pl. i., represents a portion of the specimen presented to us by the late Prof. R. Harkness, showing lamellæ of quartz and feldspar (both represented vertically); also the striping or "striation" (characteristic of plagioclases) intersecting the feldspar layers nearly at a right angle, and taken by Dr. Carpenter for "tubular structure." Fig. 3, pl. ix., represents a small portion, slightly under the natural size, of a beautiful and interesting specimen (5 inches by 2 inches) which has been kindly placed, with others, in our hands by Dr. Heddle, the mineralogist of Scotland. The inter-lamellation of the quartz (brown in the figure) and the feldspar purple is both "strictly limited" and of "definite form." The feldspar, which from its silvery appearance, seems to be of the variety called "moon-stone," is obliquely intersected by what appear to be laminæ of a triclinic feldspar, inasmuch as they are crossed with striæ ; similar laminæ are seen in the specimens of orthoclase represented in fig. 4, pl. i. Our figure of Dr. Heddle's affords but a poor idea of its beauty and remarkable structural character. (King and Rowney. An old chapter of the Geol. Rec. pp. xli, xlii, 1881.)

PERRY, J. B. A Review of Sir Charles Lyell's Student's Elements of Geology. *Bibliotheca Sacra*, July, 1872.

Notices unfavourably Sir Charles's acceptance of "Eozoon." (King and Rowney. An old chapter of the Geol. Rec., p. xxix, 1881.)

PHILLIPS (PROF.), J. Geology of Oxford and the Valley of the Thames. 1871.

"Only in another part of the world among strata of gneiss as old, if not older, than these of Malvern, has one solitary organic body been found—*Eozoon Canadense.* This foraminifer or sponge has not obtained its certificate, 'proved by the ends of being, to have been,' without protest," p. 61. (King and Rowney. An old chapter of the Geol. Rec., pp. xxvi, xxvii, 1881.)

SCHULTZE (PROF.), M. *Eozoon Canadense. Sitzungs, der niederrheinischen Gesell. für Natur–und Heilkunde*, July 7, 1873.

A translation is published in the "Annals and Magazine of Natural History," ser. 4, vol. xiii, pp. 324, 325.

Prof. Schultze, having examined specimens of the presumed fossil, avers "there can be no serious doubt as to the foraminiferous nature of *Eozoon Canadense.*" (King and Rowney. An old chapter of the Geol. Rec., p. xxix, 1881.)

SIX, A. *Soc. Géol. du Nord. Annales*, tome vi, 1878–79. 1879. Eozoon.

SMYTH, W. W., in his Anniversary Address. *Quart. Journ. Geol. Soc.*, vol. xxiii, p. lxiv, 1867.

As President of the Geological Society, noticing the announcement made by Dr. Dawson of "the occurrence of *Eozoon* preserved simply in carbonate of lime," declared that this "discovery of *Eozoon* preserved in carbonate of lime pure and simple would appear to close the discussion." (King and Rowney. An old chapter of the Geol. Rec., pp. xxi, 1881.)

VON COTTA, B. Die Geologie der Gegenaart (Eozoon), pp. 29, 94, 95, 99, 118, 266, 1872.

WILSON, C. M. Corals or Reef-building Animals. [" Protozoa" (*sic* and repeated in text) is the title of the head.] *Trans. Clifton Coll. Sci. Soc.*, vol. ii, pt. ii, pp. 63–70, 1877.

Describes the structure of Eozoon and the growth of Corals. (Geol. Rec., p. 323, 1877.)

ZIRKEL (PROF.), F. *Neues Jahrb. f. Mineralogie*, 1870, p. 828, 1870.

ZIRKEL, F. Die mikroscopische Berschaff. der Min. und Gesteine, pp. 313, 1873.

Note on Eozoon.

After describing the roundish grains of serpetine (which are considered to have been originally peridote) occurring in the crystalline limestones (hemithrenes) of Aker, Pargas, Modum (Scandinavia), the author's investigations, it is stated, "did not reveal the canal system which is called eozoonal structure." But it must be mentioned that we have detected in specimens from Aker beautiful examples of "canal system." (King and Rowney. An old chapter of the Geol. Rec., p. xxvi, 1881.)

ZITTLE, K. A. and W. P. SCHIMPER. Handbuch der Paläeontologie, 1879.

The authors reject the organic origin of "Eozoon." (King and Rowney. An old chapter of the Geol. Rec., p. xlix, 1881.)

NORTH AND SOUTH AMERICA.

AGASSIZ, A. (Letter No. 1.). To C. P. Patterson, Superintendent Coast Survey, Washington, D. C., from Alexander Agassiz, on the Dredging Operations of the United States Coast Survey Steamer "Blake," during parts of January and February, 1878. *Bull. Mus. Comp. Zoöl.*, vol. v, pp. 1–9, 1878.

ALDRICH, T. H. Observations upon the Tertiary of Alabama. *Amer. Journ. Sci.*, ser. 3, vol. xxx, pp. 300–308, 1885.

ALDRICH, T. H. Notes on the distribution of Tertiary Fossils in Alabama and Mississippi. *Journ. Cinn. Soc. Nat. Hist.*, vol. viii, pp. 256, 257, 1886.

ANON. Fossil Foraminifera in the Greensand of New Jersey —Prof. J. W. Bailey. (Extract from Silliman's Journ., July, 1841.) *Ann. and Mag. Nat. Hist.*, vol. viii, pp. 158, 159, 1842.

ANON. Globigerinæ. *Amer. Journ. Micro. and Pop. Sci.*, vol. i, pp. 125–128, 3 woodcuts, 1 pl., 1876.

ANON. Separating Foraminifera from Sand. *Amer. Journ. Micro.* and *Pop. Sci.*, vol. v, p. 96, 1880.

From the *American Naturalist.*

BAILEY, J. W. Letter from Professor J. W. Bailey, U. S. Military Academy, at West Point, relative to the characteristics deducible from specimens of bottom, brought up in sounding the Florida section of the Gulf Stream. U. S. Coast Surv., 1855, p. 360, 1855.

BAILEY, J. W. The Basin of the Atlantic, according to the deep-sea soundings. Microscopic Examination. *Maury's Sailing Directions*, Eighth Edition, vol. i, pp. 167–175, 1858.

BAILEY, J. W. General Report of the results of my microscopic examination of the soundings made by Lieutenant O. H. Berryman, in his recent voyage, in the United States Steamer Arctic, to Ireland and back. *Maury's Sailing Directions*, Eighth Edition, vol. i, pp. 163–165, 1858.

BARTLETT, J. R. The Gulf Stream. Additional Data from the Investigations of the Coast and Geodetic Steamer "Blake." *Journ. Amer. Geog. Soc.*, vol. lxiv, pp. 69–84, 1882.

CONRAD, T. A. Observations on a portion of the Atlantic Tertiary Region, with a description of new species of organic remains. *Second Bull., of the Proceed. of the National Institution*, pp. 171, 192, 1842.

Mentions the finding of Nummulites Mantelli in the Southern States.

CONRAD, T. A. Observations on the Geology of a part of East Florida, with a Catalogue of Recent Shells of the Coast. *Amer. Journ. Sci.*, ser. 2, vol. ii, pp. 36–48, 1846.

CONRAD, T. A. Tertiary of Warren Co., Mississippi. *Amer. Journ. Sci.*, ser. 2, vol. ii, pp. 124, 125, 1846.

CONRAD, T. A. Check List of the Invertebrate Fossils of North America. Eocene and Oligocene. *Smith. Misc. Coll.*, No. 200, pp. 1, 21, 33, 1866.

DANA, J. D. Note on the Discovery of Rhizopods in the Azoic. *Amer. Journ. Sci.*, ser. 2, vol. xl, p. 391, 1865.

DAWSON, G. M. "On a new species of *Loftusia* from British Columbia." *Ann. and Mag. Nat. Hist.* ser. 5, vol. ii, p. 344, 1878.

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Index to Authors of Supplement I.

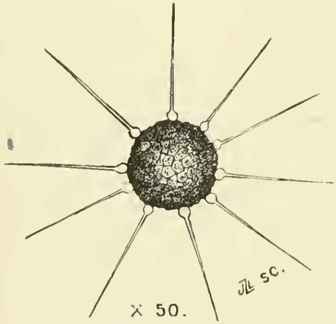
THE FUNGUS, PHYLLACTINIA GUTTATA, LEV., ON LEAVES OF CELASTRUS SCANDENS, L., CLIMBING BITTER-SWEET.

BY THE REV. J. L. ZABRISKIE.

(*A Description of Exhibit No.* 2, *of the Programme of October* 21*st*, 1887.)

The Fungi under which this exhibit is classified, popularly known as "Blights," are interesting on account of both their destructive nature, and their peculiar fruit. To those who examine them for the first time, they usually afford quite a surprise in the fact that such striking forms of fruit are borne by such abundantly common, but to them, hitherto unknown plants.

Phyllactinia guttata, Lev., is no exception to this statement. The mycelium is found as a delicate, evanescent web, on both sides of the leaves of many trees and herbs of our country. The fruit is a globular, dark-brown conceptacle, nearly .01 of an inch in diameter, with a reticulated surface, and furnished with from eight to twelve appendages, which radiate from the horizontal circumference of the conceptacle, and lie nearly flat upon the surface of the host-plant. These appendages are hyaline, rigid, and simple. They arise from a prominent bulb at the periphery of the conceptacle, taper gradually to a point, extend for a distance a little greater than the diameter of the conceptacle, and bear a striking resemblance to empty thermometer tubes. Each conceptacle contains from four to twenty sacks, or sporangia, and each sporangium has from two to four smooth, elliptical spores, filled with granular contents.



Phyllactinia Guttata, Lev.

THE MOUTH-PARTS OF CICADA.

BY F. W. LEGGETT.

(*A Description of Exhibit No.* 2, *of the Programme of November* 4*th*, 1887.)

The specimens exhibited this evening are implements contained within the proboscis of *Cicada*. They are six in number; but a careless examination would lead one to suppose their number to be but four. This is because the hooked gouges appear as one piece, until separated; when they are found to be a serrated gouge within a gouge; the hooks turned in different directions, and one projecting beyond the other. The two other implements are long rods, sloped, near the outer ends, to a rather sharp point. On this slope are located six knobs. The inner side is straight and finely serrated.

There is a peculiarity about *Cicada* that does not appear to be noted, that is, its ability to retain life, when deprived of that generally-considered necessary appendage, the head. On August 17th I captured one, just emerging from its pupa-state. In some way one of its wings was injured. At 4 P. M., of the same day, I amputated its head, and mounted its mouth-parts. At 10 P. M., as the trunk exhibited vigorous signs of life, I laid it carefully away. At 7½ A. M., of the next day—August 18th —the trunk was moving the legs, and endeavoring to move the wings; at 5 P. M., still living and twitching the wings and feet; at 10 P. M., when I went to bed, it was still alive. It died sometime during the night, at what hour I am unable to state, but it lived 30 hours, at least, without its head. Query: Did it die from the effect of the amputation, or lack of food?

REPORT UPON THE EXAMINATION OF THE FASOLDT TEST-PLATES.

BY P. H. DUDLEY, C. E.

(*Presented October* 21*st*, 1887.)

Being in Albany recently I accepted an invitation from Mr. Chas. Fasoldt to examine Test-Plates of his ruling, as shown by his new vertical illuminator, lamp, and specially-constructed microscope. It was an interesting and instructive evening. For,

besides the delicate rulings, there was much to interest the microscopist in the special apparatus for comparing micrometers and measures.

The stand is one constructed by Mr. Fasoldt, substituting a screw movement to the body of the microscope, instead of the ordinary rack and pinion. It is quick, but firm, and cannot be displaced by accident and crush a ruling.

His vertical illuminator has, like Beck's, a thin glass for a reflector. But the method of mounting, construction of the diaphragms, and means to control the light, are entirely different, making it a valuable accessory. The mechanical stage is constructed for the purpose of making fine measurements, and comparing micrometers. The screw is of recent construction, 100 threads to the inch, carrying on one end a wheel 2¼ inches in diameter, and ¼ inch broad, graduated with 100 spaces, each 0.07 of an inch long, for each $\frac{1}{10000}$ forward movement of the screw. The pitch of the screw is very uniform, and enables the manipulator to readily place the different bands of the ruling under high power objectives; then by focussing it can be determined whether they can be resolved.

The eye-piece carries a delicate micrometer, which has three delicate steel prongs, in lieu of cobwebs, or lines on glass. Each prong is adjustable, extending part way across the field. One is in the upper part, and two are in the lower part of the field. The advantages of the prongs are many, one being that but part of the line is covered.

The lamp has a single wick, two inches wide. In trimming, the wick is curved from edge to edge; the centre being fully ⅛ of an inch higher than the edges. The chimney is specially formed of a metallic frame, carrying parallel plate-glass sides; those opposite the width of the flame are about 3×4 inches, and those opposite the edges are 3×2 inches. On the top of the frame is put a metallic tube, about 1¼ inches diameter, and 14 inches high, to produce the draught. The flame is large, and burns very white and steady. In use the lamp is placed from two to four feet from the microscope, the edge of the flame being turned towards the illuminator. A small condenser, of two inches focus, is placed before the illuminator, so as to throw an image of the flame obliquely across the band of lines. The entire field is not equally illuminated, as better results are ob-

tained by having different portions of different degrees of brightness.

Photomicrograph No. 1 is of a Test-Plate having 19 bands—said to have bands ranging from 5,000 lines per inch, to the 18th, which has 120,000 lines per inch. The 19th band only has 50,000 lines per inch of the same depth of cutting as the 18th band. These bands all having been resolved, new plates were ruled, having finer bands.

Photomicrograph No. 2 is of a Test-Plate with bands in the metric measures. In one important respect the system of ruling on this plate was modified. Each band, for a short portion of its length, was only ruled with one-half of the number of lines in the rest of the band. The label sent to put on this No. 2 is probably not the proper one, as the bands do not agree.

Photomicrograph No. 3 is of a Test-Plate having 23 bands; the highest having, it is said, 200,000 lines per inch. The ruling is very delicate, and the lines quite shallow, as must be the case. Mr. Fasoldt says twelve persons have seen the lines in the last band, under his method of illumination, and with a Bausch & Lomb $\frac{1}{12}$ objective, N. A. 1.35 (?).

The first evening I looked at the Test-Plate, I saw the lines in the band of 130,000, clear and well defined, after the instrument was focussed. Unaided I was unable to go beyond the 90,000 band. This trial was made after a railroad trip of ten week-days and five nights. The vision was not as acute, and the touch of the fingers was not as sensitive as usual. In about a week afterwards, at a second trial, I saw all of the lines to the 160,000 band, which I was unable to resolve. The 170,000 and 180,000 bands I did not resolve, but the 190,000 band came out sharp and clear. This was all I could do at that time. The delicacy of focussing is probably as difficult as the discerning of the lines.

Photomicrograph No. 4 is of a quadruple ruling, the central bands being 80,000 per inch. When both sets of lines are illuminated the spectra produced are gorgeous. Mr. Fasoldt states that rulings, which do not produce spectra, are not resolvable. And he discards such rulings, as the lines are ruined.

These rulings are of very great interest to the microscopist, as a measure of what can be done by different methods of illumination. After many trials by transmitted light, the band of

90,000 lines per inch was the most I could resolve. Mr. Fasoldt says the 110,000 band is the highest one he knows to have been resolved by the same $\frac{1}{12}$ objective by transmitted light. It would be very interesting to know what kind of rulings Prof. Abbe used in determining the theoretical resolving power of an objective, as well as the method of illumination.

AN ICHNEUMON-FLY, *MICROGASTER*, PARASITIC ON THE LARVA OF A HAWK-MOTH.

BY F. W. LEGGETT.

(*Read October 7th,* 1887.)

This parasite lays its eggs within the body of the larva of the Hawk-Moth. For this purpose it pierces the softer parts of the body with its ovipositor, but carefully avoids vital spots.

When the egg is hatched, the grub eats the body of the larva until fully fed, makes a hole through its skin, and, emerging, commences spinning a beautiful white cocoon, attaching this carefully to the still-living body of its late home.

This cocoon is provided with a very perfectly-fitting door, which, when the imago is ready, he opens, and a full-fledged Ichneumon-fly appears, winged for flight. All cocoons, however, do not have the door attachment. When this is absent the imago bites a hole through the cocoon with its mandibles.

It is remarkable how completely these parasites consume the larva, and how long the larva retains life. When it dies it collapses, and its skin can be inflated like a bladder.

If I am not in error, these parasites are infested with parasites, which can be seen, both in the larva and imago, under the microscopes.

Under one microscope is the larva of an Ichneumon-fly fully fed, taken as it emerged from the body of the larva of a Moth. Under the other microscope are some cocoons with the imago emerging, and also free. In a bottle is a Hawk-Moth larva with Ichneumon cocoons attached. The glass-covered box contains some cocoons, and a number of Ichneumon-flies, living and dead. It will be observed that these cocoons do not have doors, or covers.

THE FUNGUS, PHRAGMIDIUM MUCRONATUM, LK., VAR. AMERICANUM, PECK, THE ROSE BRAND.

BY THE REV. J. L. ZABRISKIE.

A Description of Exhibit No. 1, *of the Programme of November 4th*, 1887.)

This Fungus infests both surfaces of living leaves of the cultivated Rose. It has two forms of fruit : (1) the earlier Uredospores, which are unicellular, sub-oval, and of bright orange color ; (2) these later Brand-spores, which are dark brown, five to nine septate, terminal joint mucronate ; the compound spore being supported on a lengthened peduncle, which is hyaline, fusiform and incrassated below.

X 250.

Phragmidium Mucronatum, Lk., Var. Americanum, Peck.

Our State Botanist, Prof. C. H. Peck, says, "American specimens generally have the spores more opaque, and with two or three more septa than the typical form. This variant form might be called, var. *Americanum.*" (28th Rep., p. 86.)

The specimen here exhibited has an eight-celled spore, with a nucleus visible in each cell, notwithstanding the dark color of the cell-walls.

The specimen may perhaps be interesting from the fact that it was mounted in glycerine, and sealed with white-zinc cement on March 17, 1880, more than seven and a half years ago, and still seems to be in perfect condition.

PROCEEDINGS.

Meeting of October 7th, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Thirty-four persons present.

Mr. C. W. Brown was elected a Resident Member, and Mr. C. E. Beecher was elected a Corresponding Member of the Society.

A telegram from Mr. P. H. Dudley, dated Springfield Depot, Mass., expressing his regret for his inability to be present, and presenting his congratulations to the Society on the opening of its Autumn sessions, was received during the meeting, and was read from the chair.

The Committee on Publications reported on the difficulties unavoidably connected with the issue of the current volume of the Journal of the Society.

The President read a Paper on "Hairs of the Peach in relation to Hay Fever," illustrated by diagrams and mounted objects. This Paper is published in the Journal, Vol. III., p. 62.

Mr. F. W. Devoe criticised the views of Dr. Woakes, quoted in this Paper, especially deprecating the treatment of the disease by surgery, and advancing the opinion, that to the pollen of the Rag-weed was attributable much of the nasal irritation suffered by the victims of this malady.

Mr. F. W. Leggett read a Paper on "An Ichneumon Fly, *Microgaster*, parasitic on the Larva of a Hawk-Moth." This Paper is published in this number of the Journal, p. 84.

Mr. E. B. Grove read a Paper on "The Striated Muscle-Fibre of the Head of *Harpalus caliginosus*, Fab." This Paper is published in this number of the Journal, p. 28.

Dr. L. Schöney addressed the Society on the Comma Bacillus of Koch.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

1. Section of the Cuticle of the Peach ; showing hairs *in situ* : Exhibited by J. L. Zabriskie.

2. Hairs from the Cuticle of the Peach ; showing spores of Fungus and Mycelium : Exhibited by J. L. Zabriskie.

3. *Volvox globator* : Exhibited by C. S. Shultz.

4. Spiracles of the Great Water-Beetle, *Dytiscus marginalis* : Exhibited and explained by C. S. Shultz.

5. Ovipositor of *Cicada septendecim*, L., the Seventeen-year Locust, and twigs pierced by the same : Exhibited and explained by C. S. Shultz.

6. Larva, Cocoon and Imago of an Ichneumon Fly, *Microgaster*, attached to the Larva of a Hawk-Moth : Exhibited and explained by F. W. Leggett.

7. Striated Muscle-Fibre of the Head of *Harpalus caliginosus*, Fab.: Exhibited by E. B. Grove.

8. Diamond Mica, from Pike's Peak : Exhibited and explained by E. B. Grove.

OTHER EXHIBITS.

9. Pollen of the Rag-weed, *Ambrosia artemisiæfolia*, L.: Exhibited by F. W. Devoe.

10. Section of Felspar ; polarized : Exhibited by T. B. Briggs.

11. Type-slide of marine *Navicula*, mounted by Thum, of Leipsic : Exhibited by E. A. Schultze.

12. Oolitic Sand, from Australia : Exhibited by H. W. Calef.

13. Fruit of the Zanzibar Lily, *Nymphæa Zanzibar* : Exhibited by W. E. Damon.

OBJECTS FROM THE SOCIETY'S CABINET.

14. *Megilla maculata*, De Geer.

The *Coccinellidæ*, Lady-birds, to which this species belongs, can be distinguished by the short legs, tarsi three-jointed ; the body hemispherical in form ; the antennæ usually short and retractile, enlarged at the tips, and inserted at the inner front margin of the eyes ; the maxillæ with two ciliate lobes, palpi four-jointed, last joint hatchet-shaped ; the coloration usually of a red or yellow ground with black spots, or black ground with red or yellow spots.

Over 1,000 species are at present known, from all parts of the globe. 142 species, and 18 varieties inhabit America, north of Mexico ; and 126 species, and 89 varieties are found in Europe.

15. Mouth-parts of the Honey-Bee.

Meeting of October 21st, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Thirty-seven persons present.

Messrs. A. S. Brown and Thomas Craig were elected resident members of the Society.

On motion of Mr. W. H. Mead, Prof. Samuel Lockwood, Ph.D., was invited to address the Society, on such subject and at such time as would suit his own convenience.

Mr. L. Riederer described the sections of the Head of the House-fly exhibited by him, as announced in the present programme. This exhibit consisted of several hundred consecutive sections, stained, fixed and mounted on nine slides.

The President illustrated his exhibit by a black-board drawing, and read a description of the same. This description is published in this number of the JOURNAL, p. 80. The President also donated this slide to the Cabinet of the Society.

Mr. George F. Kunz described his exhibit of sections of Meteorite, and of Meteoric Iron, and donated to the Library of the Society, reprints of Articles, published by him, as follows:—

1. "On the New Artificial Rubies," from *Transactions of the New York Academy of Sciences*, Oct. 4th, 1886

2. "Two new Meteorites from Carroll Co., Kentucky, and Catorze, Mexico," from *The American Journal of Science*, Vol. xxxiii., March, 1887.

3. "Meteoric Iron, which fell near Cabin Creek, Johnson Co., Arkansas, March 27th, 1886," from *The American Journal of Science*, Vol. xxxiii., June, 1887.

4. "Gold and Silver Ornaments from Mounds of Florida," from *The American Antiquarian*, July, 1887, read at the Buffalo meeting of the Am. Association for the Adv. of Science.

5. "Gold Ornaments from the United States of Columbia," from *The American Antiquarian*, September, 1887.

Mr. Charles E. Pellew, M. E., addressed the Society upon "The History of the Comma Bacillus," and described his exhibits of the same.

Dr. William H. Bates addressed the Society on "The History of Asiatic Cholera." This address is published in this number of the JOURNAL, p. 12.

Dr. L. Schöney addressed the Society on "Neurosis of Cholera." This address is published in this number of the JOURNAL, p. 15.

Mr. P. H. Dudley, C. E., being unavoidably absent, a communication by him on "The Comma Bacillus, the reputed cause

of Asiatic Cholera," describing the Photographs exhibited by him, as announced in the programme, was read by the Corresponding Secretary, Mr. B. Braman. This communication is published in this number of the JOURNAL, p. 18.

Mr. Wilson Macdonald also addressed the Society on his personal experiences in epidemics of Cholera.

A Report upon the examination of Test-plates, ruled by Mr. Charles Fasoldt, of Albany, N. Y., was presented to the Society by Mr. P. H. Dudley, C. E., and was read by the Recording Secretary, Mr. H. W. Calef. This Report is published in this number of the JOURNAL, p. 81.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

1. Head of House-fly in consecutive sections, transverse and longitudinal; showing the single and compound eyes, with their optic nerves, antennæ with ganglion and tracheæ, mouth-parts, etc.: Exhibited by L. RIEDERER.

2. Fruit of the Fungus *Phyllactinia guttata*, Lev., from leaves of *Celastrus scandens*, L., climbing Bitter-sweet: Exhibited by J. L. ZABRISKIE.

3. Section of Meteorite found near Forsyth, Taine Co., Mo.: Exhibited by G. F. KUNZ.

4. Section of Meteorite found at Powder Mill Creek, Cumberland Co., Tenn.: Exhibited by G. F. KUNZ.

5. Meteoric Iron from Waldron Ridge, near Taswell, Tenn.: Exhibited by G. F. KUNZ.

6. Meteoric Iron from Holland's Farm, Chattooga Co., Ga.: Exhibited by G. F. KUNZ.

All these exhibits by Mr. KUNZ were new, and were described by him.

7. Comma Bacilli; specimens of the Koch, Finkler, Prior, and other Bacilli: Exhibited by C. E. PELLEW, and used in illustrating his remarks.

8. Photomicrograph of cultures of Comma Bacillus, the reputed cause of Asiatic Cholera: Exhibited by P. H. DUDLEY.

9. Photomicrograph, showing destruction of the mucous membrane of intestine of cholera patient: Exhibited by P. H. DUDLEY.

10. Photomicrographs by dark-ground illumination of four of Mr. Charles Fasoldt's test-plates, showing the number and position of the bands: Exhibited and explained by P. H. DUDLEY

By Mr. Fasoldt's special apparatus and method of illumination, several persons have seen the lines of the band, said to be ruled at the rate of 200,000 lines per inch.

11. *Lacinularia socialis*, and *Bacillaria paradoxa*, living and in full action: Exhibited by W. E. DAMON.

OBJECTS FROM THE SOCIETY'S CABINET.

12. Scales of *Lepisma*, sp.

These scales belong probably to *Lepisma saccharina*. Sugar-runner, or *L. domestica*. Both species are sometimes very common about houses, where they eat holes in silks, mutilate the edges of books, and consume sugar, &c.

Lepisma saccharina, L., is uniformly dull silvery, with pale yellowish antennæ and feet. Head with fine scattered hairs; caudal stylets finely hairy with a few larger hairs. The longer caudal stylets are about half as long as the body; antennæ about two-thirds as long as the body. Length, .32 inch.

Lepisma domestica, Pack., is pearly white; body broad, covered densely with scales and mottled with dark spots, with silky white hairs. A dense fringe of long hairs at base of head, extending around in front of the eyes, and grouped in two tufts; vertex bare. The three thoracic segments are mottled with dark scales, the third being the darkest; basal abdominal segments mottled like the thoracic ones, while a few dark scales are scattered over the remaining segments, except the last one. On each side of all the segments behind the head is a sub-dorsal row of carneous tubercles, each supporting a pencil of 6–8 radiating hairs; a similar row of thicker tubercles on the side of the body. Around edge of thoracic segments a fringe of hairs, arising from short lines directed inwards, at right angles to the edge of the segments, there being seven on the mesothoracic, and three on the prothoracic ring; on metathoracic ring six lines on a side. Antennæ and median caudal stylet nearly as long as the body. Length, .50 inch. (Packard.)

13. Longitudinal and transverse sections of Whalebone.

MEETING OF NOVEMBER 4TH, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Twenty-three persons present.

In the absence of the Recording Secretary, Mr. G. E. Ashby, was appointed Secretary *pro tem.*

The Corresponding Secretary Mr. B. Braman, read a letter from Dr. S. Lockwood, accepting the invitation extended at the last meeting to address the Society, appointing the time as the 16th of December, and announcing as his subject, "The Pathology of Pollen in Æstivis or Hay Fever."

The Chairman of the Committee on Publications, Mr. F. W. Leggett, reported the completion of Vol. III., of the JOURNAL of the Society, and the encouraging condition of the fund for the same.

The President described his exhibit, as announced in the Programme, illustrating the same by a black-board drawing. This description is published elsewhere in this number of the JOURNAL.

Mr. F. W. Leggett described his exhibit as announced in the Programme. This description is published elsewhere in this number of the JOURNAL.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

1. Fruit of the Fungus, *Phragmidium mucronatum*, Lk., var. *Americanum*, Peck, the Rose Brand; mounted in glycerine, and sealed with white-zinc cement more than seven years ago: Exhibited and described by J. L. ZABRISKIE.

2. Mouth-parts of *Cicada*: Exhibited and described by F. W. LEGGETT.

OTHER EXHIBITS.

3. Section of Granite, from Round Pond, Me.: Exhibited by T. B. BRIGGS.

4. Pond-life; Rotifers: Exhibited by W. E. DAMON.

5. Consecutive sections of the head of a Wasp, *Vespa*, showing the optic nerve, &c.: Exhibited and explained by L. RIEDERER.

6. Entire head of minute Fly: Exhibited by L. RIEDERER.

7. *Amphipleura pellucida*; mounted in Prof. H. L. Smith's new medium; shown with a Powell and Lealand $\frac{1}{12}$ in. apochromatic, homogeneous immersion objective, with compensation eye-piece: Exhibited by W. G. DEWITT.

8. Head of the Soldier Beetle, *Chauliognathus Americanus*, Forst., showing a modification of the maxillæ into organs resembling "the tongue" of the Honey-Bee: Exhibited and explained by G. E. ASHBY.

OBJECTS FROM THE SOCIETY'S CABINET.

9. *Pterophorus periscelidactylus*, Fitch, the Grape Vine Plume. This species was first described by Dr. Fitch, in his first Report, 1854. The larva is pale green, with two rows of whitish tubercles along the dorsal region, and a row along each side ; from all the tubercles spring rather long, sordid white hairs. The body is also covered with very short, sordid, white hairs. Head, pale yellowish green. Length, when full grown, about 13 mm. Feeds on Grape Vine, living in the edges of one or more leaves, drawn together by silken threads. It appears in the latter part of May, or early in June, and sometimes in such numbers as to do serious injury to the vines.

The larva changes to a chrysalis in the latter part of June, and the imago emerges in about six or eight days after.

10. Transverse section of root of *Convolvulus Scammonica*.

11. Section of Kidney of Cat, stained and injected.

MEETING OF NOVEMBER 18TH, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Thirty-nine persons present.

Mr. Edgar J. Wright was elected a Resident Member of the Society.

The matter of an Annual Reception was discussed by the Society in Committee of the Whole, of which Mr. C. Van Brunt was chosen chairman. The President appointed the following members as Committee on the Annual Reception :—Messrs. Le Brun, Wales, Beuttenmüller. Mitchell and Mead. On motion it was resolved that this Committee be instructed to provide for the holding of the next Annual Reception in the Rooms of this Society.

The following members were appointed by the President as Committee on Nominations of Officers for the ensuing year :—Messrs. DeWitt, Wall and Mead.

Communications from Dr. N. L. Britton and Mr. A. J. Doherty, read by the Corresponding Secretary, were, on motion, referred to the Board of Managers.

The President read a Paper on "The Radula of the Conch," illustrated by diagrams, and objects as announced in the pro-

gramme. This Paper is published in this number of the JOURNAL, p. 1.

The President donated to the Cabinet of the Society the slide containing the median portion of the Radula of the Conch.

The Corresponding Secretary, Mr. B. Braman, read a Paper, presented by Mr. Charles E. Beecher, of the State Museum of Natural History, Albany, N. Y., and a Corresponding Member of the Society, entitled "A Method of Preparing, for Microscopical Study, the Radulæ of small species of Gasteropoda." This Paper was illustrated by two slides of Radulæ, prepared by the author, and donated to the Cabinet of the Society; and the Paper is published in this number of the JOURNAL, p. 7.

Dr. L. Schöney, in explanation of his exhibit, gave interesting information on human cancerous growths.

Mr. K. M. Cunningham, of Mobile, Ala., being present as a visitor, on request by the President, addressed the Society on the work of Microscopists in Europe, and explained his exhibits mentioned in the present programme.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

Ten objects illustrating the Paper, "The Radula of the Conch:" exhibited by J. L. ZABRISKIE:—

1. Shell of *Sycotypus canaliculatus*, Gill.
2. Operculum of the same.
3. Egg-capsules of the same.
4. The entire Radula of the same, in glycerine.
5. A slide, containing the distal end of the Radula of the same, with broken teeth.
6. A slide, containing the median portion of the Radula of the same, with perfect teeth.
7. A slide, containing the proximal end of the Radula of the same, with forming teeth.
8. The shell of our remaining species of Conch, *Fulgur carica*, Conr.
9. The entire Radula of the same, in glycerine.
10. Egg-capsules of the same.

Two objects, illustrating the Paper, "A Method of Preparing, for Microscopical Study, the Radulæ of small species of Gasteropoda":—

11. Radula of *Somatogyrus subglobosus*, Say, from the Mohawk River: Exhibited by C. E. Beecher.

12. Radula of *Amnicola limosa*, Say, from the Potomac River: Exhibited by C. E. Beecher.

13. Embryo Ants, mounted in glycerine-jelly: Exhibited by F. W. Leggett.

14. So-called Gizzard of *Blatta*, Island of St. Thomas, showing horny plates, or teeth: Exhibited by E. B. Grove.

15 So-called Gizzard of *Œdipoda Carolina*, L., showing horny plates, or teeth: Exhibited by E. B. Grove.

16. Radula of *Zonites cellarus*: Exhibited by W. G. De Witt.

17. *Pleurosigma angulatum*, under an apochromatic, homogeneous-immersion objective. Exhibited by W. G. De Witt.

18. Larva of *Corethra plumicornis*, commonly known as the Shadow-gnat: Exhibited by C. S. Shultz.

OTHER EXHIBITS.

19. Radula of *Haliotis*: Exhibited by H. W. Calef.

20. Radula of *Paludina vivipara*: Exhibited by H. W. Calef.

21. Cancerous growth (human): Exhibited by L. Schöney.

22. Models of the tongue and throat (human): Exhibited by L. Schöney.

23. "The Rotifera; or Wheel Animalcules, by C. J. Hudson, LL. D., Cantab., assisted by P. H. Gosse, F. R. S." 2 vols., 4°., illustrated; Longmans, Green & Co., London: Exhibited by C. W. Brown.

24. Slides, and numerous photomicrographs of Diatoms: Exhibited by K. M. Cunningham, of Mobile, Ala.

PROCEEDINGS OF OTHER SOCIETIES.

San Francisco Microscopical Society.

Meeting of September 28, 1887.—Vice President Dr. Ferrer took the chair, and a large number of members were present.

Dr. Henry Ferrer exhibited a new rectilinear lens, made by Steinheil, of Munich, especially for enlarging and reducing copies of drawings and charts in photographic operations. This lens secures as perfect definition at the periphery as at the center. It is accompanied by a table, by means of which one can easily calculate the needed extension of camera, and distance from the object, to secure any desired enlargement or reduction in a photograph.

Dr. Ferrer exhibited some of his work with this lens in reduced, photographic copies of his large India ink drawings of his sections of the human eye. He also exhibited these sections, which were prepared by hardening the eye in bichromate of potash, and embedding in celloidin.

Secretary Wickson read a letter, recently received from Dr. Frank L. James, of St. Louis, Editor of the *St. Louis Medical and Surgical Journal*, referring to mountings of *Bacillus anthracis in situ* in lung tissue, made by Dr. S. M. Mouser of this Society, and stating "that a better preparation never has been made." The letter also cited the verdict of Dr. D. V. Dean, of St. Louis, a thorough microscopist, who pronounced "the slide the best he had ever seen."

Dr. Henry Ferrer was elected President of the Society, to fill the vacancy occasioned by the resignation of Mr. Wickson, who retired from the Presidency to take the office of Recording Secretary.

Meeting of October 12.—President Dr. Ferrer in the chair. A large number of members were present.

A letter was read from Mr. Isaac C. Thompson, F. R. M. S., of Liverpool, England. Mr. Thompson desires to secure material for the study of minute crustaceans, a special line of investigation which he has pursued for some time, and upon which he has made valuable reports to the Liverpool Microscopical Society. His letter prescribed the following as a solution best fitted to preserve specimens of marine life: Water, one part; proof spirits, two parts; glycerine, one part; with one per cent. of carbolic acid added. By securing gatherings from the Pacific Mr. Thompson hopes to add to his previous finds of new *Copepoda*. In an expedition to the Canary Islands he captured from forty to fifty new species. The San Francisco Society will endeavor to obtain the material desired.

A letter was read from Mr. W. F. Barraud, of Wellington, New Zealand. The Wellington Microscopical Society meets fortnightly, and its members are investigating and cataloguing the fresh-water infusoria of the district. Mr. Barraud sent a sample of the rich diatomaceous deposit at Oomaru, New Zealand, and a sample of the Nevada salmon-colored diatomaceous earth, found some time ago by Prof. Hanks, will be sent to Mr. Barraud in exchange.

The chief part of the evening was given to an exhibition of high power objectives recently received. Drs. Ferrer and Mouser exhibited one-twelfth Zeiss objectives, and Dr. Le Conte used Spencer's one-tenth and one-eighteenth. Dr. Mouser worked his one-twelfth up to 2,250 diameters with admirable effects. The performance of the Spencer glasses was also very satisfactory.

Mr. William Payzant, of Berkeley, was elected Vice President, to fill the vacancy caused by the election of Dr. Ferrer to the Presidency.

Meeting of October 26.—President Ferrer in the chair. Dr. Julius Rosenthirn of San Francisco, was elected a regular member.

A letter was received from A. H. Breckenfeld, of Los Angelos, accompanying specimens of marine diatoms on sea-weed, from Prof. Romyn Hitchcock, and collected at Sakai, Japan.

Dr. Ferrer exhibited accessories. He had just received from Zeiss, of Jena, a number of low power objectives and oculars, made of the new apochromatic

glass. Among these were projecting eye-pieces, for use with the micro-camera in photography. Comparisons were also made between the Zeiss ordinary eye-piece and the "compensating eye-piece."

The Society received donations of material intrinsically valuable, and highly prized because of its associations. "Moeller's typen platte" and "probe platte," a number of valuable photomicrographs, and a large number of slides, part of the collection of the late Prof. W. Ashburner, were donated by Mrs. Ashburner, through Mr. Norris. Mr. Norris also donated a number of slides, and prepared diatomaceous material.

Mr. Norris exhibited a slide, mounted by Bourgoyne, of Paris, which contained 215 distinct varieties of diatoms from the Santa Monica earth, all arranged in beautiful form.

Meeting of November 9.—President Ferrer in the chair. Dr. Douglas Montgomery and Dr. Kahn, of San Francisco, were elected regular members.

A sample of Mono lake water was handed in by Dr. Mouser, and it was referred to Mr. Payzant for the determination of its contained crustaceans.

Mr. Henry G. Hanks read a paper on Rock Salt, found at San Bernardino County, California. This salt occurs in blocks, usually of such transparency that print can easily be read through cubes of it which may be several inches thick. Some specimens exhibit faint lines and spangles which are the angles and surfaces of box-like cavities, probably containing gas or atmospheric air, which fact causes these specimens to explode violently when heated. Mr. Hanks illustrated his paper with specimens under the microscope.

William Irelan, Jr., State Mineralogist, donated to the Society two specimens of diatomaceous earth, one from Dos Pueblos Creek, Santa Barbara County, and the other from Shasta County. These specimens were referred to Mr. Riedy and Dr. Riehl for examination and report.

Brooklyn Microscopical Society.

Meeting of November 21, 1887.—The regular meeting was held—twenty-nine persons being present—at the new Laboratory and Lecture Room of the Packer Institute, at the invitation of Prof. W. Le Conte Stevens.

On request of the members Prof. Stevens explained the improvements in the Lecture Room, made under his supervision, and the members were then conducted through the Laboratory.

Dr. J. H. Hunt then took the chair, in the absence of the President, G. D. Hiscox, and the routine business of the Society was transacted.

The Society was then entertained by a lantern exhibition, prepared by Prof. Stevens, in which, among numbers of beautiful objects, there were shown by polarized light various rock-sections, chemical crystals, stained glass, selenite films in many designs, including geometrical patterns, and many uniaxial and biaxial crystals.

Meeting of December 5.—A regular meeting was held for the first time at the new permanent home of the Society in the Pratt Institute—Ryerson Street, near Willoughby Ave., Brooklyn—twenty-three persons being present.

Objects exhibited :—

Fern-leaf Gold crystals ; by Dr. A. J. Watts.

Crystals of native Gold ; by E. A. Chapman.

Crustaceans and specimens of Pond-life ; by C. H. Taylor.

Pigeon-post Film, of the siege of Paris, and a Hydrazoan, *Eucratia chilata* : by H. W. Calef.

Cancerous growth, *Carcinoma ;* by H. A. Tucker, Jr.

Lozenge-shaped crystals of Asparagine ; by Geo. B. Scott.

Slides of mineral substances—Chromium, Silicon, Boron, Cadmium, &c.; by Geo. M. Mather.

Various slides of native Copper, and cabinet specimens of the same ; by Dr. J. H. Hunt.

Sections of Black Granite and Felspar ; by T. B. Briggs.
Pyrite, said to be volcanic ; by G. D. Hiscox.
Sori of a rare West Indian Fern ; by G. E. Ashby.
Pseudo-scorpion ; by H. S. Woodman.
Seeds of Wild Carrot ; by J. W. Freckleton.
Fragment of shell of *Echinus*, with a spine ; by James Walker.
Transverse section of stem of Potatoe, showing collenchyma ; and lactiferous vessels of *Scorzonera Hispanica* ; by J. W. Martens, Jr.

Medical Microscopical Society of Brooklyn.

This Society meets at the residences of the members, on the first Wednesday of each month, excepting the months of July and August.

The officers for the year 1887 are, Pres., Dr. W. H. Bates ; Cor. Sec., Dr. H. D. Bliss ; Treas., Dr. Albert Brinkman ; Rec. Sec., Dr. J. M. Van Cott, Jr.

The membership is limited to twenty active members, who must be physicians and working microscopists, each one of whom is expected to present one paper each year, on some subject pertaining to the object of the Society ; and five associate members, who must be physicians, and interested in microscopy, although they may not be working microscopists.

Meeting of September 7, 1887.—Held at the residence of Dr. J. M. Van Cott, Jr. A good number of the members were present. Dr. Van Cott read the paper of the evening, which was illustrated by microscopical sections, stained with alum-carmine, and which elicited full discussion, and the presenting of some clinical histories.

Meeting of October 5.—Held at the residence of Dr. R. G. Eccles. Dr. Eccles read a paper, entitled "Thallophytes in Medicinal Solutions." This paper was amply illustrated by microscopical preparations, diagrams, and specimens of solutions containing Thallophytes, and it led to a vigorous discussion of the subject.

Meeting of November 2.—Held at the residence of Dr. Herbert Fearn. Dr. Arnold Stub read the paper of the evening, which was thoroughly discussed by the large number of members present.

Essex County Microscopical Society of New Jersey.

Meeting of November 2, 1887.—Held at the residence of the Rev. F. B. Carter, Montclair, N. J. A large number of members was present.

After the transaction of routine business a paper on the *Rhizopoda* was read by Mr. Carter, who has studied these low forms of animal life during several years. The paper, which treated of the different species of Rhizopods, their classification, habits, external and internal structure, modes of reproduction, &c., was followed by a lantern exhibit ; the slides used for this purpose being prepared by Mr. Carter.

Among many representations thrown upon the screen, may be specially mentioned those of *Amœba princeps*, with its nucleus, contractile vesicle, and pseudopodia ; also the reproduction by division through the nucleus, in the case of *Amœba proteus*, and by spores, in the case of *Microgromia socialis* ; and the structure of the tests of many other species.

A paper on the subject, "Tooth Development," by the President, Geo. S. Allan, D. D. S., was announced for the next meeting, to be held on November 17.

THE JOURNAL OF MORPHOLOGY.—We hereby acknowledge the receipt from the publishers, Ginn & Co., Boston (7 Tremont Place), New York and Chicago, of the first number of the *Journal of Morphology*, edited by C. O. Whitman, Ph. D., Director of the Lake Laboratory, Milwaukee, Wis., recently of the Museum of Comparative Zoölogy, Cambridge, Mass., with the co-operation of Edward Phelps Allis, Jr., Milwaukee, Wis.

This journal is devoted to the presentation of original research in embryology, anatomy and histology. It is in crown octavo form; intended to be issued in annual volumes, of from two to four numbers, of 150 to 200 pages each, with from five to ten lithographic plates. Subscription price: for Vol. I (two numbers), $6.00; single numbers, $3.50.

The first number, dated September, 1887, embraces 226 pages, with seven double lithographic plates, and one heliotype plate, illustrating the following articles:

I. *Sphyranura Osleri*, a contribution to American Helminthology. By Prof. R. Ramsay Wright and A. B. Macallum, University College, Toronto, Canada.

II. The Development of the Compound Eyes of *Crangon*. By Dr. J. S. Kingsley, Professor of Zoölogy in the State University of Indiana.

III. Eyes of Mollusks and Arthropods. By Dr. William Patten, Assistant in the Lake Laboratory, Milwaukee, Wis.

IV. On the Phylogenetic Arrangement of the *Sauropsida*. By Dr. G. Baur, Assistant in Yale College Museum, New Haven, Conn.

V. A Contribution to the History of the Germ-layers in *Clepsine*. By C. O. Whitman, Ph. D., Director of the Lake Laboratory, Milwaukee, Wis

VI. The Germ-bands of *Lumbricus*. By Prof. E. B. Wilson, Bryn Mawr College, Bryn Mawr, Pa.

VII. Studies on the Eyes of Arthropods. By Dr. William Patten, Assistant in the Lake Laboratory, Milwaukee, Wis. 1. Development of the eyes of *Vespa*, with Observations on the Ocelli of some Insects.

Number 2 of this volume, to be dated December, 1887, is announced to embrace ten lithographic plates, and the following contents:

I. The Kinetic Phenomena of the Egg during Maturation and Fecundation (*Oökinesis*). By C. O. Whitman, Ph. D.

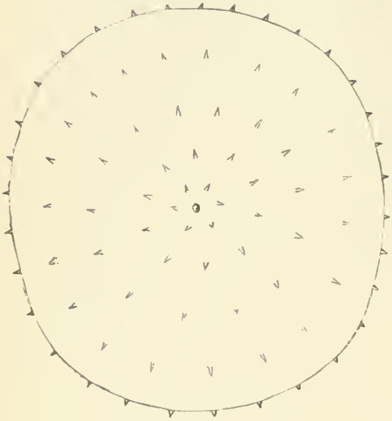
II. The Embryology of *Petromyzon*. By Dr. W. B. Scott, Princeton College, N. J.

III. A contribution to the Embyrology of the Lizard. By Dr. Henry Orr, Princeton, N. J.

IV. The Fœtal Membranes of the Marsupials. By Dr. H F. Osborn, Princeton College, N. J.

V. Some Observations on the Mental Powers of Spiders. By George W. and Elizabeth G. Peckham, Milwaukee, Wis.

It is a magnificent publication In it our country may take pardonable pride as a noble initial effort of its kind within our own borders We are gratified to know that the Publishers state to their patrons, "The *Journal* has without question taken the very first rank among periodicals of its kind both here and abroad." And we hope the rising scientific interest in our country will clearly and effectually see the advantage of sustaining such a publication of our own, and of assisting it to attain a grand financial success.



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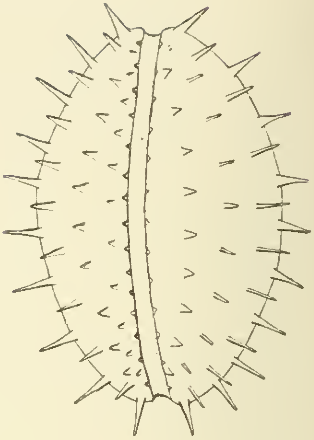

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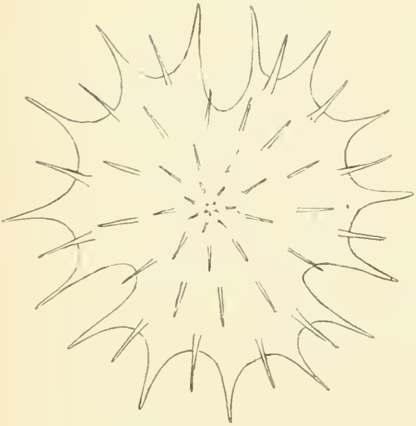

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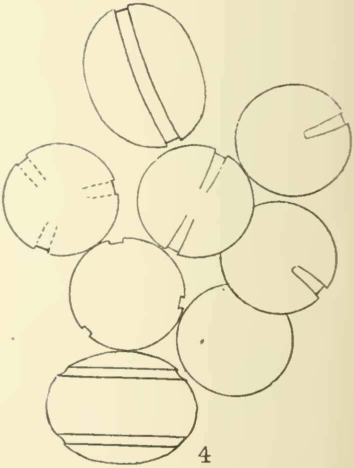

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LOCKWOOD ON POLLEN.

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THE PATHOLOGY OF POLLEN IN ÆSTIVIS, OR HAY-FEVER.

BY PROF. SAMUEL LOCKWOOD, PH. D.

(*Read December 16th*, 1887.)

Certain places in the White Mountains of New Hampshire have become notable as summer resorts for sufferers from Æstivis, or Hay-Fever. A number of these sanitaria lie more or less contiguous to the sources of the Saco river, on the one side, and the sources of the Connecticut on the other.

When the South winds prevail in either of these long tracts, there is a lowering of the barometer, and at the same time a nervous depression of the subjects of Hay-Fever. There is also another change in the atmosphere, which is then laden with the dust-produce of these valleys. A marked element in this dust is pollen, chiefly that of Rag-weed and Golden-rod, which, especially the former, abounds in the South, in the months of August and September. At such a time the suffering among

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Explanation of Plate 11.

FIG. 1.—Pollen of Rag-weed, *Ambrosia artemisiæfolia*, L.: size, $\frac{1}{1200} \times \frac{1}{1500}$ inch.

FIG. 2.—Pollen of Golden-rod, *Solidago squarrosa*, Muhl.: end view, showing spines of two lengths, and trilobate depressions ; size, $\frac{1}{860} \times \frac{1}{1000}$ inch.

FIG. 3.—Pollen of *S. squarrosa;* side view, showing one of the three longitudina grooves, which, in figure 2, are indicated by the trilobes.

FIG. 4.—A diagram of a group of pollens of *S. squarrosa*. Two are side views, and six are end views.

The figures are necessarily diagrammatic, For figures 1, 2 and 3 I am indebted to Dr. Alfred C. Stokes. S. Lockwood.

the Hay-Fever guests is severe and general. Happily it does not continue, but passes off with the change of wind. On the theory of a *neurosis*, the cause seems plain to me. With the sudden humidity of the atmosphere, and low barometer, the tonic of the mountain air is dissipated, and nervous depression results. Then, since the air in this condition is surcharged with pollen, and other impurities, the nerve endings of the respiratory passages are irritated unto acute inflammation.

At the closing session of the United States Hay-Fever Association, last September, at Bethlehem, N. H., a long-cherished desire was revived to learn the relative hygienic quality of the favored sanitaria, and that of places where the malady prevails. Owing to my official relation, it fell to me to state the factors in such a determination.

The problem to be solved might be called the Hygiene of the Atmosphere. It would involve, all through, consideration based upon instrumental work. This would need such records of the winds, humidity, range of the barometer and thermometer, as fall to the meteorologist. The impurities, organic and inorganic, of the atmosphere must also be considered, which side of the work would fall to the microscopist. If density were added, this would cover all.

A word as to the conveyability of material particles by the atmosphere. There is something *ad captandum* in the splurge of the lugubrious poet :—

"The dust we tread upon was once alive."

But, in the present tense, how true is this of the dust we breathe ! Can we not recall the painful interest excited by Tyndall's experiments on the impurities of the atmosphere ? And, for our purpose, how easy to repeat some of them. Let a beam of sunlight through a hole in the shutter enter a dark room. It appears as a slanting, living column. I say *living*, for every particle seems in motion, due to the incessant dancing movements of millions of motes.

If now a small spirit-flame, yielding no smoke, be held under this beam, there will soon be seen a dark hole right through the column. Withdraw the flame, and soon the contiguous motes dance into it ; it is again illumined, and the dark hole disap-

pears. If now we pass a red-hot bar through it, the beam will be divided into two parts by a black space. The bar withdrawn, soon the neighboring motes dance into it, and the beam is all light again.

The deduction, for our purpose, is that the so-called impurities present are chiefly organic, and the heat burns them out. The spores, infusoria, and microbic matter are thus destroyed—the air literally being purified by fire.

All these things, even the mineral matter constitute the aerial dust so distressing to the sufferer from Hay-Fever. And I hold that a prominent irritant in the air, during the Hay-Fever season, is pollen.

But what is pollen ? It is the fertilizing granule produced by the stamens of a flower. These granules vary greatly in size and form, in the different flowers. Some are smooth, others are angular, but those, with which this discussion will deal, are globular, or elliptical, spiny, and very minute. Not noticing the pollen of the grasses, which particularly affect the early forms of the disease, perhaps the most mischievous of the pollens are those of the Rag-weed, and the Golden-rods. I have here specimens of the plants ; Rag-weed, *Ambrosia artemisiæfolia*, L., and the Golden-rods, *Solidago altissima*, L., *S. lanceolata*, L., and *S. squarrosa*, Muhl., which three forms are typical. I have here also, under these microscopes, pollen of all these plants, mounted on slides ; also here are enlarged drawings of the pollens.

Fresh Rag-weed pollen is very nearly spherical. The granule measures in these specimens, which are a little distorted by long drying, $\frac{1}{1200}$ inch in length by $\frac{1}{1500}$ inch in width. In a fresh specimen, or such as floats in the summer air, so fine are the points of the spines that they are to that of a cambric needle, as it is to the point of a marling-spike, or even a crow-bar. And yet this object, with its subtle armature is literally invisible to the unaided sight. See Fig. 1.

The pollen-grains of the Golden-rods are sub-elliptical, both ends being of the same size. They are very spiny, and the spines are relatively longer than those on the pollen of the Rag-weed. They are of two lengths on the same granule. The pollen of *S. altissima*, the most abundant, in these parts, of the many species, is in length $\frac{7}{6000}$ inch, and in width $\frac{1}{1000}$ inch.

The flowers are in a recurved panicle, not unlike the graceful spray of an ostrich plume.

An abundant species is the *S. lanceolata*, whose flowers are borne in scattered corymbs, or flattish topped clusters, something in the manner of the Wild Carrot, which habit is in striking contrast with the Golden-rods generally. This pollen makes a narrower ellipse than the one just mentioned, the two diameters being $\frac{1}{1000}$ and $\frac{1}{1500}$ inch respectively.

S. squarrosa is less common than the other two species. The flowers are more conspicuous, and arranged in a showy wand, or sceptre-like spike. Its pollen measures $\frac{1}{860}$ by $\frac{1}{1000}$ inch, hence it is larger than that of *S. altissima.*

And exceedingly interesting is the end view, since it shows a tripartite disposition, being as it were depressed at three points. Now these depressions are simply the terminations of three longitudinal canals on the sides. The end view is shown in Fig. 2 ; and Fig. 3 shows one of the longitudinal grooves. I find these marks much fainter in *S. altissima*, and barely discernable in *S. lanceolata.*

We have now noticed three points which are pertinent to the discussion, as will appear, namely : the minuteness of these pollen-grains, their spiny armature, and the naked grooving at the surface.

1.—The first effect noticeable of pollen then is due to its presence in the air as an impurity. The granules are taken in at breathing, as a foreign element. Except that it is more pungent, their action is in common with that of other impurities —namely suffocating. Advanced Hay-Fever is always more or less asthmatic, and impurities in the air will cause spasms, and in some instances even the odor of domestic animals will bring this about.

2.—But pollen, taken into the respiratory tubes, is a mechanical irritant. In severe Hay-Fever all the air-passages are in a state of inflammation. The starting spot is in the vicinity of the nares. At first the patient does not dislike the tickling of the pungent grains of titillating dust. But it very soon becomes serious, and nature summons all the sternutatory forces to eject the intruders. So violent does this sternutation become, and so long continuous, that the blood is started from the nostrils. The

mucuous membrane of the nose, and the immediate air-passages become super-sensitive. In fact the entire mucous surface is soon in a scalded state, and every nerve-ending is a participant of torture. Suppose a person's back to be in that state of eczema, in which inflammation has reached suppuration, and a thistle-bur to be put down the back. The rest may be left to imagination. Now suppose that a number of grains of pollen of Rag-weed, or Golden-rod, with which the air is laden, to be inhaled, when the whole nasal region and the ducts beyond are scalded with the incessant discharge of acrid secretions. Is not each one of these infinitesimal teasels a lacerator of the tender and inflamed membrane? Hence when these enter in myriads —what a combination for exquisite torture! I have been caught in a place where Rag-weed pollen was prevalent in the air, and have been seized with sudden spasms, so violent that I have had to cling to a fence for support under suffering that was inexpressible.

3.—Besides being a mechanical irritant because of the spines, I am persuaded that pollen has a toxic quality in Hay-Fever. In plainer words it poisons the already inflamed tissues of the respiratory passages. No one doubts that, to some persons, skin-poisoning is a certainty. upon walking on the lee-side of the toxic Sumach, *Rhus venenata*, in its flowering time. Why not then a toxic effect of pollen upon the mucous linings already super-sensitive, and even lacerated by their presence?

In the old herbals the *Solidago*, as the word almost implies, had a reputation for vulnerable virtues, it being used in treating wounds. One of the species, *S. odorata*, yields an aromatic oil, on distillation. It cannot then, I think, be inert upon the surface of the inflamed, and minutely lacerated mucous membrane. The laceration facilitates the poisoning. But there is another possibility in this matter. The copious nasal secretions, acrid and warm—have they no power for extracting the toxic principle?

4.—And, lastly, I am constrained to believe that pollen, in Æstivis, is a vital automaton—that it can, as a living organism. perforate the mucous lining, actuated on the principle of a pseudo-instinct; not altogether unlike the Carrion-fly, when it deposits its eggs, by mistake, on the decaying, nitrogenous

fungus, instead of putrid flesh. If we are to understand by instinct, "inherited experience," it is to be found even in plants. It is true that we are told *how* the Hop twines to the left, and the Scarlet-runner to the right, but back of the "how" lies the "why?" And occasionally we find a change of habit in an individual plant, as left-handness is found among rational beings.

I must be permitted now to deal with some elementary ideas on the subject of fertilization by the pollen-grain. In respect to the several pollens herein described, each must be regarded as a highly organized cell, with a twofold shell—an outer rind, which is thick, and carries the armature of spines; and an inner one, which is thin, in fact, a membrane, which is exposed at the surface in grooves, spots or pores, and these exposed places are always smooth. In the Golden-rods, as shown in the figures, these depressions are longitudinal grooves. The interior of the pollen consists of a viscid life-stuff, or protoplasm, whose function is to fertilize the ovule, at the base of the style in the pistillate flower. To effect this a curious play of the life-force sets in. The style is composed in part of a loose, or more or less spongy tissue, while the stigma at the top is charged with a saccharine, sticky mucilage. A pollen-grain, borne by the wind, or an insect, usually, now falls upon the stigma, and is anchored to it by the spines sinking into the gum. The moisture causes the grain to swell. There is a protrusion of the membrane at one or more of the thin places at the surface, whence a tube, or root-like process emerges, and penetrates the stigma. It seems to be an extension in tubular form of the membrane, and is filled with the protoplasm of the cell. If the kid-glove on a lady's hand could be pinched at the back, and that nip of the glove pulled out or extended, and the flesh could flow into this extemporized little pipe, it would roughly represent the pollen tube. Having pierced the outer coat of the stigma, this tubule, by a sort of growth, keeps on lengthening, and pushing its way down through the loose tissue of the style, until it has reached the ovule at the base, when its mission ends, and the future seed of that flower is assured.

Now to return to my statement of mistaken instinct in the insect. Pseudo-instinct is also found in plants, even in the

initial life-processes. The surcharged nectary of a flower may appear in a place approachable to a pollen-grain. Should the granule alight upon that viscid spot, out would pop the pollen-tube, with the usual effort to pierce the epidermis of the flower, but in vain. Indeed we can easily deceive the pollen-grain, by dropping it upon moistened sugar, and even witness this out-put of the tubule.

The point I would now make is this—that a similar pseudo-instinct prevails with the pollen-grain, when it is inhaled, and falls upon the moist and tender tissues of the inflamed linings of the respiratory passages. All the favoring conditions are there—moisture, softness and warmth. Hence results an instinctive protrusion of the pollen-tube into the puffy, inflamed and exquisitely sensitive tissues. I think this parasitical action has to do with that acute stinging sensation in the nostrils so frequent in Æstivis.

Thus have been instanced four possible modes of action for pollen in Hay-Fever.

1.—Its suffocating effect as an impurity of the atmosphere, thus exciting asthma.

2.—As a mechanical irritant begetting inflammation, even to excoriation of the mucous membrane.

3.—As a toxic agent, poisoning the tissues.

4.—As a pseudo-parasite, penetrating the soft and sensitive parts.

It should be added that these activities are here supposed to operate upon the system while in an abnormal state. In a word behind all there is a Hay-Fever neurosis. As the nasal ducts are the first to show suffering in Hay-Fever, and the malady thence extends to all the respiratory organs, as well as other parts of the system, I think it bodes good that in addition to the long-known "Laryngological Association," the medical fraternity have effected a new organization under the name "Rhinological." This new society is to concern itself with the ailments of the nose hypothecating the fact that diseases of the throat and larynx almost always have their origin in the nasal region.

INAUGURAL ADDRESS OF THE PRESIDENT, CHARLES F. COX.

(*Delivered January 20th*, 1888.)

I appreciate very highly the good will and good opinion implied in my election to the presidency of this Society, and shall feel greatly gratified if I am able to serve you acceptably in the position to which you have chosen me, and to assist you in the promotion of that department of science in which we are all most deeply interested. I hope that, during the year upon which we have just entered, the Society will continue in the successful path which it has followed hitherto and that we shall work on with the same quiet, unpretentious and undemonstrative zeal with which we have pursued our course heretofore, and which is certainly the habit of mind most befitting the humble devotees of Nature.

There are times in the history of every organization like this when the question : *Is any really worthy purpose being accomplished?* comes home to the membership with oppressive force ; and I cannot help thinking that there is too strong a tendency to test the matter by the narrow criterion of merely visible results.

But our success is not to be measured by the amount of stir which we are able to make in the world around us ; nor is it to be gauged by the quantity of so-called original matter which we may produce and publish. It can never be less than an unspeakable pleasure to discover a new fact or to devise a novel and useful process, and I am sure that every such achievement by one of our members will be regarded as a credit to the Society and a subject of just pride to us all. Nevertheless, I cannot consider *origination* as our chief and paramount aim. On the contrary, it seems to me that the object of such an association as this must be the acquisition and accumulation of knowledge for ourselves much more than the propagation and dissemination of it amongst others. In my opinion, it will be no serious reproach to us if we are looked upon as "a mutual benefit society," and I judge that we shall furnish a sufficient reason for our organized existence if we keep alive amongst ourselves an intelligent and progressive interest in our particular branch of

learning, and stimulate and develop in one another a true love for and devotion to the worthy cause of scientific truth. More than this we may indeed hope to do ; but beyond this we are not really bound to go. I do not know who may rightfully complain if, as a society, we even hold to the character which Emerson has ascribed to the great man, " who, in the midst of the crowd, keeps with perfect sweetness the independence of solitude ;" for discoveries worth proclaiming to the world are not made every two or three weeks, but inspiration and elevation *are* to be obtained from the frequent contemplation of the facts made known to us by the instrument around which it is our pleasure to gather and from which it is our pride to take our name.

And yet it is not long since some professed advocates of the popularization of science went through the form of reading us microscopists out of the general body of scientists, on the ground that we were not entitled to fellowship or encouragement because we were only "*amateurs*" (that is to say *lovers* of science), were "hangers-on to the regular scientific army," were "universal gatherers," and were undertaking to divide the sciences according to the tools used ;" and we were spoken of contemptuously as "delighting in a formidable and extensive deal of brass stand."

To most of these charges it was hardly necessary to put in any formal defense, for it was obvious that the *animus* of the attack upon us was the old-fashioned delusion that there is some kind of merit in doing scientific work with poor appliances. But another phase of this general notion has recently manifested itself in a vigorous onslaught upon American microscopes, for which, with evident appropriateness, the vehicle selected has been the journal which three years ago promulgated the now celebrated bull of excommunication. According to the latest champion of scientific orthodoxy, who declares that he has "seen and examined a great many different stands, and the lenses of many manufacturers,"—"it is undesirable to recommend a student to purchase any microscope whatsoever of American manufacture," but it *is* desirable "to always counsel him to obtain, if possible, one of the German or French instruments," which, as nearly as I can make out, conform to the common

model of twenty-five or thirty years ago. The general objection to American stands seems to be that they furnish more mechanism than the particular worker who wrote the complaint happens to require for his particular work. He makes a more specific charge, however, that they have a joint in the body by means of which they *may* be tipped out of a vertical position, when the makers ought to have known that he and his pupils never *care* to tip their microscopes ; and another specification is made of the fact that the length of the tube has not been determined solely with reference to the height of the table or the chair which this rather exacting critic commonly employs ;—at least this is the inference I draw from his demand that tubes should never be made longer than suits *his* convenience.

Now, I presume you find it as difficult as I do to understand why all supposed faults are laid at the doors of American manufacturers ; for surely all bad microscopes are not American, even if all American microscopes are bad. But the unreasonable and sweeping denunciation in which this somewhat self-opinionated iconoclast indulges is only another illustration of the familiar phenomenon of blotting out all the rest of the world by holding a comparatively small object close to one's eye ; for here is an acknowledged expert in histology who is so completely absorbed in his specialty as to be entirely oblivious to, or regardless of, the instrumental needs of all other branches of microscopy. In common with others who have lately made public display of their ignorance of the vastness and variety of microscopical research, he would actually prescribe "for one that uses the microscope for real work" a single simple pattern which, as you may imagine, would be pretty strictly limited to the requirements of his own restricted field of investigation. Instruments which perhaps meet the demands of different classes of observers are "constructed with a view of entrapping inexperienced purchasers."[1]

1. It is only right to say that since these remarks were written, Dr. Minot has replied to some of his critics by a letter, published in *Science*, in which he disclaims having made an exhaustive examination of all forms of American microscopes and professes to have written previously "only in regard to microscopes suitable for biological and particularly histological work." I feel bound to say, however, that, taking his first letter by itself, the inferences I have drawn seem to me entirely justified, and I believe them to be such as must have occurred to nearly every reader of that letter. It is therefore to be regretted that he did not, in the first instance, exercise that calmness of judgment and carefulness of expression which are incumbent upon one who makes public announcement of a grave opinion. But, even in reference to biological or histological stands, he has to confess that he had overlooked the work of one of our oldest and best known manufacturers, and perhaps he will now learn that there are still others of whom he ought to have been informed before giving out his all-inclusive condemnation.

Unfortunately, this sort of narrow opposition to the inevitable elaboration of scientific implements is not a thing which decreases with the general increase of knowledge. It has accompanied every step in the development of the microscope and its accessories, and I suppose it will go right on in the future; for I can hardly imagine a time when some specialist will not think it praiseworthy to contemn "the latest improvements," and take personal pride in pointing to the results of his own labors accomplished by the use of only the simplest mechanical aids.

Within a short time we have heard learned sermons preached upon the superiority of specimens prepared without the employment of circular cover-glasses and, of course, without the assistance of the turn-table. It was admitted that they were not very attractive to the naked eye; but then there was "no nonsense" about them,—they were intended "*for use!*" So, too, we have witnessed a later contest over the microtome. What earnest homilies we have listened to upon the superlative excellence of the German method of free-hand section-cutting, and how positively we have been assured that all mechanical section-cutters were only delusions and snares! I have to admit that some of the later developments of this accessory are rather formidable-looking engines which seem capable almost of cutting timber for commercial purposes; but I notice that the gentleman who denounces all American microscopes, as being too complicated, is himself the inventor of one of these elaborate slicing machines. Yet the automatic microtome plainly has come to stay. So have the mechanical stage, the swinging sub-stage, and many other contrivances over which we have seen battle waged.

Shall we ever forget the terrific struggle with which the homogeneous-immersion lens was obliged to win its way to a footing in the microscopical world? Men of no small importance blocked the road, not with drawn swords, but with drawn diagrams which most certainly proved, if they proved anything, that an angle of more than 180° was an optical impossibility and that, no matter what people might *think* they saw, they at all events could not see round a corner; for, as old John Trumbull wrote,

"Optics sharp it needs, I ween,
To see what is not to be seen."

But now how perverse and prejudiced all that opposition seems, and how simple and reasonable the new system of numerical aperture is seen to be !

Before our time, the fight was fought over the binocular body, the achromatic objective, and even the "compound" principle itself. I happened, only the other day, to take up one of Dr. Hill's volumes published in 1752,[1] in which I found an illustration of the spirit of opposition of which I have been speaking ; for he iterates and reiterates his belief in the general superiority of the single microscope over the compound, for all genuine investigation. We can easily believe that the compound microscope, previous to the invention of the achromatic objective, was a rather inefficient instrument. Still, in the light of our present knowledge, it is exceedingly amusing to read such a passage as the following :

"Thus much I have thought it necessary to say in Favour of the Use of single Magnifiers of great Power, in the more nice Investigations, because I know their being difficult and Disagreeable in the using has thrown them into an unmerited disregard, a Neglect that Will clip the Wings of all succeeding Discoveries. The Microscope, as we hear of it in the Hands of Lewenhoek, and in those of all the other Authors, who have so amazingly seen the Minima of Nature, and who have inspired the World with a Love for its Investigations, was a single Glass of this kind. Almost all the great Discoveries which have rendered the Instrument famous, were made by single Glasses. These are the only ones to trace with Accuracy the Ways of Nature in these her minutest Productions ; nor are those who are acquainted only with the Use of that Plaything the double Microscope, to wonder that they cannot follow the Discoveries of Men who have used these single Glasses in the making them ; or accuse People of Imposition or Fancy who have used in their Investigations an Apparatus which is so superior in real Value to that by which they vainly attempt to follow their steps. The double Microscope is the Instrument for those who would be diverted by the Powers of magnifying, but this is that which ought to be understood and employed by all who would make real Discov-

1. *Essays in Natural History and Philosophy*, containing a Series of Discoveries by the Assistance of Microscopes, by John Hill, M. D.

eries ; that may be necessary as a first Step to this, but 'tis the single Glass of the first Power that is to determine all." With a little change,—so as to make it apply to the simple, rigid European stand as against the ample, adjustable English and American model,—the foregoing paragraph would appear quite modern.

And yet, while we must deprecate the practice of belittling and berating every new instrumental aid placed at our disposal, we must admit that there is another extreme to which enthusiasts or charlatans occasionally go and which also is deserving of unsparing condemnation. I refer to the making of extravagant and unwarranted statements as to the capabilities of the microscope or of efforts to excite undue wonder at the results of its use. This is not a fault common to the class of microscopists, and is not exactly the sin charged upon us by our would-be excommunicators. This is merely the showman's trick of picturing his prodigies just a little more prodigious than the living realities. It is the subterfuge of the quack, an artifice of the cheap lecturer. Even when it is resorted to in sober earnest it has its droll and entertaining aspect, as well as its serious and instructive side.

Thus, not unlike Sam Weller's "patent double million magnifyin' gas microscope of hextra power," with which one might "see through a flight o'stairs and a deal door," must have been that astonishing instrument with which Dr. Highmore claimed that it was possible to see the magnetic emanation of the loadstone. And a still more amusing case of circumstantial mendacity or of clever fiction is that quoted from Father Noel D'Argonne,[1] in that curious work, attributed to Dr. John Campbell, entitled "*Hermippus Redivivus, or the Sage's Triumph over Old Age and the Grave.*" According to this extraordinary relation, the author, while on a visit to London, made the acquaintance of a tradesman who, in return for a slight courtesy, with some show of mystery, presented to the Frenchman "an instrument in a tortoishell case, which proved to be a most excellent microscope." Our author goes on to say : "I may well bestow this epithet upon it, since it was so excellent as not only to discover an infinity of bodies imperceptible to the naked

1. *Mélange d'histoire et de literature*, par M. De Vigneul—Marville, Paris, 1700.

eye, but even the atoms of Epicurus, the subtile matter of Des Cartes, the vapours of the earth, those which flow from our own bodies, and such as derive to us here the influence of the stars."

"The first experiment I made," he continues, "was looking on the person from whom I receiv'd it, at the distance of four or five paces, which gave me the opportunity of discerning an infinite number of little worms that were feeding most voraciously upon his cloaths, by which I perceived that contrary to the common opinion it is not we who wear out our cloaths but they are fairly eaten off our backs by these invisible insects."

Amongst other astonishing performances of this remarkable instrument was its disclosing the secret of personal sympathy and antipathy, which is set forth by the imaginative Frenchman in the following words:

"Going out of the house, we saw four young men playing at ball. I, at first sight, felt a strong inclination in favour of one, and as strong an aversion against another, whence I began earnestly to wish that this might win and that might lose. I examined both with the microscope and thereby easily distinguished the source of these passions. As the men were extremely heated with their exercise, they perspired strongly, so that clouds of the matter flowing from them reached us. My glass shewed me distinctly that the matter perspired by him for whom I had an inclination was exactly similar to what was perspired by myself; whereas the matter flowing from the other person was absolutely unlike to mine in all respects, and so jagged and bearded that it seemed to wound and pierce me like so many arrows. Hence I discerned that the true cause of our sudden inclinations and aversions consists in the figures of the matter perspiring from us and from others, and in the similarity or contrariety of these insensible vapours."

It may be that the writer of this ingenious narrative was dealing only in allegory. But, without doubt, it is in the utmost seriousness that the author of a book but lately published in Boston puts forth even more astounding revelations,[1] professedly in the words of an anonymous "Scientist," who, by means of an original arrangement of lenses, hit upon the awful discovery of "the departing soul with its astral covering." But

1. *The Hidden Way Across the Threshold*, by J. C. Street.

there was a preliminary experiment which is worth describing in the "Scientist's" own language, although that language is not always strictly grammatical. "My attention," says he, "was first attracted to these truths by a patient of mine lying upon a sofa suffering with pain in his foot, and yet *there was no foot*, the leg having been amputated nearly to the hip and the wound had healed quite nicely. I found that not until I had the limb and foot disinterred and placed in a natural position (the foot having been thoughtlessly placed beside the amputated limb at burial), did the patient's suffering cease. This being done, he gained in flesh, slept well, grew strong, and never again complained of his foot. For a long time this incident ran in my mind, until at last I resolved upon an experiment. Procuring the most powerful lenses I could find, I completed an invention of my own, and, when my light was so perfectly arranged that I could examine the microbes in the air, called upon a patient who had lost his arm, and had also suffered in a similar manner, explaining to him that I wanted him to put his imaginary hand where I directed. He laughingly accompanied me to my rooms and did as I desired. The moment I adjusted the glass, a new world and light of revelation broke upon me. *The dual hand lay beneath my glass.* I asked him to make letters with his imaginary finger. He did so, and, to his wonder and astonishment, I spelled out the sentences he thus wrote. This was to me conclusive evidence of an ethereal second self."

After being led along to this point, we can readily imagine how the grand climax was reached in "a second experiment of great difficulty" which was then undertaken. "The time finally arrived," says our "Scientist," "where I had proper conditions of light, etc., where a man of more than ordinary spirituality was being called over to the silent majority. I watched the hours go by till the moment came when he was about to cease breathing and a sudden tremor passing through his body announced his hour had come. 'Now is our time,' I whispered to the friend who was assisting me. We passed our heads under a black cloth and bent our eyes intently upon the object-glass. Particles of dust in the air were magnified several thousand times, and for a time their motion kept a perfect dazzle upon the glass. Then a thin violet column of vapor gathered into a soft cloud * * *."

But why continue the touching details ! You must know the rest already. You who have often focused down upon the floating specks in a trembling drop of water, have groped your way in search of the nervous rotifer, and at last have "caught" him in the wavering field of your objective, can perhaps bring to your minds the sensations of this accomplished "Scientist" when at last he turned his truly wonderful lens from the floating dust of the atmosphere upon a materializing human spirit and beheld it "gather its forces into a little sphere and pass out into the sunlight of the everlasting morrow."

This I take to be the very sublimity of humbuggery, but a useful lesson may be learned from even such nonsense if, upon seeing to what absurd lengths a pretence of knowledge and the spirit of wonder-working can go, we are strengthened in our determination to resist every temptation to exaggeration,—to oppose every tendency to mere sensation. Old George Baker[1] pointed out the only good and safe position, when he said, "Some People have made false Pretences and ridiculous Boasts of seeing, by their Glasses, the Atoms of Epicurus, the subtile Matter of Des Cartes, the Effluvia of Bodies, the Emanations from the Stars and other such like Impossibilities. But let no ingenious and honest Observer give Credit to these romantic Stories, or misspend his Time and bewilder his Brains in following such idle Imaginations, when there lies before him an Infinity of real Objects, that may be examined with Ease, Profit and Delight."

Now, I have not spoken of this subject because I suppose that this society has any special need of the warning conveyed in the quotations just made. Indeed, I may say with entire sincerity that there is here as little necessity to preach a healthful conservatism as in any organization with which I have ever been connected. I have, however, purposely brought into juxtaposition the two extremes of error with reference to our favorite instrument, because I cannot see anything better in underrating the value of our mechanical appliances than in overestimating the capabilities of our lenses ; and I have hoped to point a moral which, perhaps, might be expressed in Wordsworth's couplet :

1. *The Microscope Made Easy.* London, 1743.

"He is oft the wisest man
Who is not wise at all."

The microscope is an instrument of precise investigation, capable of application in many various directions. It is, therefore, as a product of evolution in the domain of mechanics and optics, a collection of numerous parts possessing, as a whole, "a definite, coherent heterogeneity," and it is vain to expect a return to the condition of "indefinite homogeneity" which characterized the simple stand of a third of a century ago. We of this society take delight in and are proud of all that has been done to evolve and perfect the useful and noble instrument with which we are privileged to work; but we fully recognize the fact that this beautiful mechanism is but the key to the treasury of minute nature. The pursuit of truth is our ultimate aim as well as our immediate employment; and in this pursuit we find our present benefit and final greatest good. For, as Edgar A. Poe has said, "*Not in knowledge is happiness, but in the acquisition of knowledge. In forever knowing we are forever blessed.*"

BEAUTIFUL MICRO-POLARISCOPE OBJECTS.

BY D. H. BRIGGS.

(*Read January 6th*, 1888.)

Aside from strictly scientific uses the micro-polariscope has a field of interest in exhibiting some of the most splendid phenomena in the whole range of microscopical manipulation.

Not only do many substances exhibit beautiful forms and colors in what may be called their normal mode of crystallization, but, when the crystals are formed under peculiar conditions, the effects are sometimes truly wonderful.

Having experimented to a considerable extent in this matter, I thought it might be of some interest to this Society to give the results of my experiments.

Out of a large number of substances, I select two, which are capable of being prepared in such a manner, that they will exhibit forms and colors of uncommon beauty. These are Salicin and Hippuric Acid.

First, however, I will name the necessary implements for the work. For a source of heat, I find a coal-oil lamp, with tall

glass chimney the best. I use the "Harvard burner," with a tin reservoir for the oil, six inches in diameter by about two inches in depth. I would remark, by the way, that the crystals appear much better by lamp-light than by day-light.

For a vessel, in which to heat and dissolve the substances, I find a small chemical flask, of two fluid ounces capacity, the most convenient, as it can be held over the lamp by grasping the neck with forceps, of which I find steel, artery forceps, of five inches length, the best. One advantage of the flask is that it does not lose the contained liquid very rapidly by evaporation. The forceps will also be needed for holding the glass slip, and the thin glass cover.

A block of cast-iron, five by eight by two inches, with one side planed, is used for the rapid cooling of the preparations. Glass slips, thin covers and Canada balsam will suggest themselves.

Salicin is soluble in 5.6 parts cold, and very largely in boiling water. The crystals deposited from a solution by cooling are in the form of needles, and frequently stellate groups appear, even under these circumstances. But to get the finest crystalline formations of this substance, I use the following method :—

First, prepare in the little flask, before mentioned, a solution in hot distilled water. The best results are obtained with a solution somewhat below the point of saturation. Add a trace of clean, pure gum-arabic, pulverized, a piece as large as a moderate sized grain of wheat, to each one-half fluid ounce of the solution. The use of the gum is to retard the formation of the crystals, and thereby enable the operator to obtain much better results. If, however, too much gum is added, persistent bubbles will be formed in the deposit on the slide.

Next filter the hot solution, being careful that funnel, flask, etc., are clean, and free from all traces of oily matter.

To prepare the slide, which first must be made clean, hold the slip in the forceps by one end ; warm over the lamp ; remove, and pour on the end, opposite the forceps, enough of the hot solution to flow over as much of the slide as possible, and not come in contact with the forceps, being very careful not to allow any of the solution to run over. Now heat the slide over the lamp, mostly at the end opposite to that held by the forceps, causing some boiling ; and then, by slight motion of the slide,

make the liquid to circulate so as to keep the solution of uniform temperature and concentration. Remove from over the lamp, and, after one or two seconds, run off the liquid from the corner of the slip into the flask. Then hold the slide over the lamp until rosettes begin to form, and, when these are almost as large as desired for the central discs, place the slide at once on the cold iron. This will stop the process of crystallization, and after the slide is cooled, crystallization can be started again by heating, when a rim will be formed on the rosettes of any size, depending on the length of time during which the heat is applied. The growth of the rim can be stopped by cooling.

When the crystals are satisfactory, and just sufficiently cold to stop crystallization, immediately put a drop of balsam on a thin cover, which, held by the forceps, can be heated over the lamp, and applied to the slip. The balsam can be made to spread by warming the slide, cover side down, over the lamp.

If properly prepared, the amorphous deposit of Salicin will remain in that condition, and cause the rosettes to appear on a black back-ground, when viewed with the prisms at right angles in the microscope.

Another substance, which can be made to crystallize in very beautiful forms with much less trouble than Salicin, is Hippuric Acid.

Of this substance a concentrated but not saturated solution in hot, absolute alcohol is prepared in the little flask ; the glass slip heated over the lamp ; the hot solution poured on the end of the slip, and flowed over the centre, with some ebullition, and immediately run off into the flask. Wait a few seconds until the rosettes begin to form on the slide, and then quickly place on the cold iron, until the slide is cool. Now examine with the microscope, when presently the rosettes will begin to radiate a fringe around their circumference. This can be accelerated by allowing the breath to come in contact with the slip. When the discs are nearly of the size desired the process will be stopped, or rather changed in character, by slightly warming over the lamp for one or two seconds, and then cooling, and proceeding as before, if further developments are desired. When the crystals cover the surface seal on the thin glass cover.

If properly prepared these slides are very vivid in color in the polariscope, and exhibit also very pleasing forms.

PROCEEDINGS.

Meeting of December 2d, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Thirty-seven persons present.

The Rev. A. B. Hervey was elected a Corresponding Member, and Mr. Frank Healy was elected a Resident Member of the Society.

Messrs. Mead, Woolman, Wales, Calef and Devoe gave full and interesting explanations of their several exhibits, as announced in the present programme.

Mr. P. H. Dudley read the following notes on fungi, in explanation of his exhibits, Nos. 7 and 8 of the programme of this meeting.

NOTES ON *Lentinus lepideus*, FR., AND *Trametes pini*, FR.

"Finding these two species of fungus fruiting upon the same piece of Yellow Pine, *Pinus palustris*, Mill., is of considerable scientific, as well as of practical importance.

"Scientific Interest:—1. It shows that the difference in appearance, between mycelium so often found in the upper portion of Yellow Pine railroad ties, and that generally found in the lower portion, is due to distinct species of fungus, and not to a polymorphism of mycelium of one species.

"2. That two species of fungus, having distinct external characteristics, are, by growth, able to break down and reduce similar compounds under nearly the same external conditions.

"Practical Importance:—1. For this immediate vicinity, so far as yet observed, the rate of destruction, caused by *Lentinus lepideus*, Fr., in the duramen of Yellow Pine ties, is over three times that caused by *Trametes pini*, Fr.

"2. *Lentinus lepideus*, Fr., in gravel or cinder ballast, attacks first the portions of the ties which are imbedded, and grows upward; while *Trametes pini*, Fr., attacks first the exposed ends of the ties, the mycelium working slowly inward and downward.

"This shows that the former needs more moisture, and exclusion from air-currents, for its growth. Therefore, if the Yellow Pine ties are only imbedded in the ballast sufficiently for the stability of the track, the rate of decay for the entire tie, as

caused by *Lentinus lepideus*, Fr., will be retarded; though the exposed ends of the ties will be more subject to the attacks of *Trametes pini*, Fr. Nevertheless, the rate of decay, caused by the last-named fungus, being slower, the service of the Yellow Pine Ties is prolonged by the less depth of imbedding in the ballast.

"It must be understood, that the decay of ties of all species of wood will not be retarded by less imbedding in the ballast. On the contrary the decay of ties of some woods is retarded by full imbedding.

"In securing pieces of decayed Yellow Pine ties from the main tracks of a railroad for microscopical study, it is rare to find, in fruit, the fungus which has induced decay. The mycelium, and its method of destruction only remain to indicate what caused the decay. A slight difference in color was frequently noted between the mycelium found in the lower, and that found in the upper portion of the Yellow Pine ties; but the cause was not understood until, in the Fall of 1886, I found both species of fungus, herein mentioned, fruiting upon the same Yellow Pine track-stringer for the transfer-table, at the Grand Central Station. Both species also fruited on the same stringer the present season. Specimens of each fungus are in the boxes for exhibition.

"*Sphæria pilifera*, Fr., often attacks new Yellow Pine ties in transit from the South. The mycelium penetrates the resin-ducts and cells of the medullary rays of the alburnum, the dark filaments discoloring the portion of wood attacked. If such wood dries, or is treated before putting it in the ground, the decay, for the time being, is arrested. The final decay of the wood may be due to a subsequent attack of another species of fungus, the mycelium of each often being found in the same wood-cell. This is especially true of decayed sheathing from freight-cars. Much of it is attacked by fungi, discoloring the wood, to some extent, before it is used on the cars. In many cases painting such wood hastens, instead of preventing decay."

Mr. Dudley also exhibited a Heliostat, of his own construction, made after the model of the Fahrenheit Heliostat, and showed the method of operating the same.

In this connection Mr. Dudley also exhibited Daguerreotypes

of microscopical objects, taken by the late Prof. John W. Draper, in 1853 or 1854, by means of a Heliostat of this same model.

Mr. George P. Scott, of Brooklyn, being present as a visitor, on request, explained the peculiar points of his microscope and its case, as announced in the programme. This microscope possesses many ingenious appliances connected with the body, the stage, and the sub-stage of the instrument. Especially noticeable among these are the contrivances by which, with a quarter revolution, the polarizer, the selenite, and the analyzer of the polarizing apparatus can instantly be brought into use, or turned to one side, so as to avoid all interference with the examination of an object by ordinary light.

Mr. W. Wales gave the Society interesting information concerning the difficulties encountered in the construction of apochromatic objectives.

A discussion followed upon the construction of sub-stages, with especial reference to the necessity of a centring arrangement for the Abbe condenser.

Mr. C. S. Shultz exhibited nine slides, beautifully prepared, and donated to the Cabinet of the Society, through him, by Miss Mary A. Booth, of Longmeadow, Mass., as announced in the programme.

On resolution the thanks of the Society were tendered Miss Booth for this gift.

Mr. G. S. Woolman presented, for distribution among the members, diatomaceous material from marine soundings, taken at the depth of 1,000 fathoms in the Gulf Stream, off the coast of New England.

Mr. A. M. Cunningham, of Mobile, Ala., through the Corresponding Secretary, donated, for distribution among the members, diatomaceous material, employed as a "Silver-polish," containing many perfect and elegant diatoms. On resolution the thanks of the Society were tendered Mr. Cunningham for this donation.

According to a request, previously made by the President, that this should be especially an "Apparatus-evening," many interesting and valuable pieces of apparatus were exhibited, as appears in the programme.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

1. The Abbe Stereoscopic Binocular Eye-Piece: exhibited by WALTER H. MEAD.

2. Cyclosis in *Vallisneria*, under a $\frac{1}{20}$ Powell and Lealand objective, and the above-mentioned eye-piece: exhibited by WALTER H. MEAD.

3. "Acme" Microscope: exhibited by G. S. WOOLMAN.

4. A Zentmayer Pocket Microscope: exhibited by W. WALES.

5. Bausch and Lomb's Concentric Microscope: exhibited by H. W. CALEF.

6. A Microscopist's Box, home-made, containing necessary articles and apparatus for work, mounting, etc.: exhibited by F. W. DEVOE.

7. Fruit and Mycelium of *Lentinus lepideus*, Fr.: exhibited by P. H. DUDLEY.

8. Fruit and Mycelium of *Trametes pini*, Fr.: exhibited by P. H. DUDLEY.

9. A Heliostat, made after the model of the Fahrenheit Heliostat: exhibited by P. H. DUDLEY.

Nine slides, prepared and donated to the Cabinet of the Society by Miss M. A. Booth: exhibited by C. S. SHULTZ, as follows:—

10 (1). *Biddulphia pulchella*, and *B. Edwardsii*; South Sea.

11 (2). *Triceratium Javanicum*; Tangaroon Mt., Java.

12 (3). Shell-scrapings; Is. of Amboina, East Indian Archipelago.

13 (4). Diatoms of the Water-supply of Leipsic, Germany.

14 (5). Diatoms from mud, found floating off the west coast of South America.

15 (6). Diatoms from mud, from Beaufort, North Carolina.

16 (7). *Aulacodiscus orientalis*, and *Chiuacosphonia monilifera*; from the Sandwich Islands.

17 (8). Diatoms from Santa Monica, California.

18 (9). Spores and elaters of Liverwort, *Conocephalus conicus*.

19. Podura-scale, under a $\frac{1}{12}$ Powell and Lealand objective: exhibited by WILLIAM G. DEWITT.

20. Larva of *Dermestes*: exhibited by F. W. LEGGETT.

21. A Microscope, with convenient appliances, and a compact case: exhibited by GEO. P. SCOTT.

OBJECTS FROM THE SOCIETY'S CABINET.

22. *Sertularia* from New Zealand.

23. Arsenious Oxide Crystals.

24. Transverse section of Rhizome of Wild Yam, *Dioscorea villosa.*

25. Proboscis of the Horse-Fly, *Tabanus atratus.*

26. Foraminifera from Dog's Bay, Connemara, Ireland.

MEETING OF DECEMBER 16TH, 1887.

The President, the Rev. J. L. Zabriskie, in the chair.

Forty-eight persons present.

On motion of Mr. Walter H. Mead the order of business was suspended, with the exception of attention to the following matters, viz.—the nomination and election of members, the Report of the Committee on nomination of Officers, and the Report of the Committee on the Annual Reception.

The Rev. K. F. Junor, M. D., was elected a Resident Member.

The Committee on nomination of Officers for the ensuing year presented their report.

Prof. Samuel Lockwood, Ph. D., addressed the Society on "The Pathology of Pollen in Æstivis, or Hay-Fever." This Address was illustrated by herbarium-specimens of the Ragweed and Golden-rod, by slides of Pollens of the same under microscopes, and by drawings of the same Pollens, and is printed in full in this number of the JOURNAL, p. 99.

On the conclusion of the Address the thanks of the Society were tendered Prof. Lockwood.

MEETING OF JANUARY 6TH, 1888.

The President, the Rev. J. L. Zabriskie, in the chair.

Thirty-two persons present.

The President presented a brief Report upon the condition of the Society.

The Treasurer, Mr. C. S. Shultz, presented his Report, of which the summary is as follows :—

Receipts, to Jan. 6th, 1888 - - -	$436.61
Disbursements. to Jan. 6th, 1888 - -	392.55
Balance, Jan. 6th, 1888 - - -	$44.06

Mr. C. F. Cox said it would be remembered that some months ago Dr. Julien read a very interesting paper upon a remarkable exhibition of phosphorescence observed in the ocean and on the beach at Long Branch, and that he (Mr. Cox) had suggested that the organism which Dr. Julien had found abounding in the water was a flagellate bacterium which was supported by the abundance of dead jelly-fish present at that time. It would be remembered, also, that Dr. Julien was inclined to attribute the phosphorescence to this bacterium-like creature, while he (Mr. Cox) was disposed to believe it to be due to the decaying substance of the acalephs. He now wished to call attention to a summary, in the Royal Microscopical Society's Journal for December, 1887, p. 1009, of investigations by Prof. J. Forster and Dr. C. B. Tilanus, into the phosphorescence of bacteria, which seemed to furnish facts in support of Dr. Julien's theory.

Mr. Cox further called attention to a communication to the Royal Microscopical Society by Dr. Henri Van Heurck (December, 1887, p. 1068), in which he replied to criticisms which he (Mr. Cox) had made upon photomicrographs sent to this Society some time ago, which criticisms, however, were erroneously attributed to Hon. J. D. Cox, of Cincinnati. Mr. Cox said he was not willing that his brother should be held responsible for any of his views. In questions relating to photomicrography General Cox was an acknowledged authority, whereas he himself professed only the most general acquaintance with the subject. He had, however, just taken from the Society's cabinet, and held in his hand, the set of photographs which had been the subject of criticism, and a re-examination of them proved that in most of them the back-ground had been painted out. He was glad to learn, from Dr. Van Heurck's letter to the Royal Microscopical Society, that he had abandoned this unde-

sirable mode of treatment, and he (Mr. Cox) felt sure that this Society would be glad to receive the new set of photographs which Dr. Van Heurck said he had sent, in illustration of his new and improved method.

Mr. P. H. Dudley being unavoidably absent, a communication from him, explaining his exhibits as announced in the programme, was read from the chair, as follows:

ROCK-SECTIONS, FROM THE ISTHMUS OF PANAMA.

"The section of rock (Wacke) from the Bujio quarry of the Panama railroad, is of considerable interest, from the fact of its extensive use for heavy masonry by the Railroad Company on the Isthmus.

"The rock is friable and porous, as a glance at the slide indicates. The fragments composing it are only feebly united, while some portions have undergone decomposition. Most of the Olivine has disappeared. Pyroxene crystals are present, sufficient in number to deepen the color of the rock, and to increase its specific gravity, the latter ranging from 2.3 to 2.5.

"In this climate exposed blocks of such rock would not withstand one winter's freezing and thawing, without extensive, if not complete disintegration. In a tropical climate it stands much better, and of necessity the Panama Railroad Company used it for all of their bridge abutments and other masonry, in which it has rendered good service, when laid in cement and kept well pointed. When used for road metal or ballast, for the railroad, it is rapidly converted into mud in the 'wet season.'

"SECTIONS OF PEBBLES.—The pebbles found in the Chagres River, at Gorgona, are from both igneous and sedimentary rocks, the former being the most abundant. The sedimentary pebbles were all argillaceous, the corners being well rounded.

"The pebbles from the igneous rocks were not, as a rule, as well rounded, many of them being quite angular.

"In slide No. 5 of the programme are a number of sections of crystals (Orthoclase), each seeming, at first sight, to form a nucleus for the surrounding material. The want of sharpness of many of the corners of the crystals, and the fact of several being broken, favor the hypothesis, that they were undergoing a process of dissolution, which was subsequently checked.

"Slide No. 6.—In the nearly transparent portions are small acicular crystals.

"Slide No. 7.—Presents the appearance of each quartz grain having a delicate cell-wall. This was originally a sedimentary rock, subsequently altered by heat, under pressure."

A communication by Mr. D. H. Briggs, of Germantown, Pa., a Corresponding Member of the Society, entitled "Beautiful Micro-polariscope Objects," illustrated by slides of crystals of Salicin, and of Hippuric Acid, as announced in the programme, was read from the chair.

These slides were prepared and donated to the Cabinet of the Society by Mr. Briggs, and the communication is published in this number of the JOURNAL, p. 115.

ELECTION OF OFFICERS.

The President announced the closing of the polls, and declared the result of the balloting to be the election of the persons, nominated at the last meeting by the Committee on nomination of Officers for the ensuing year, as follows :—

For President, C. F. COX.

For Vice-President, P. H. DUDLEY.

For Recording Secretary, G. E. ASHBY.

For Corresponding Secretary, B. BRAMAN.

For Treasurer, C. S. SHULTZ.

For Librarian, L. RIEDERER.

For Curator, W. BEUTTENMÜLLER.

For Auditors, { F. W. DEVOE, W. R. MITCHELL, F. W. LEGGETT.

PROGRAMME OF OBJECTS ANNOUNCED FOR EXHIBITION.

1. Section of Granite, from Monson, Mass.
2. Section of Granite, from Stony Creek, Conn.
3. Section of Pegmatite, or Graphic Granite,

} Exhibited by T.B.Briggs.

PEGMATITE, OR GRAPHIC GRANITE.

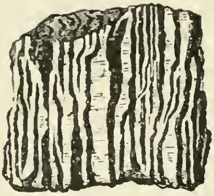
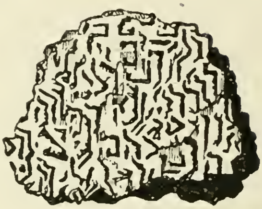



Fig. 1—Section parallel to laminæ. Fig. 2.—Section transverse to laminæ.

"Feldspar, quartz, and mica are usually considered as the minerals essential to granite, the feldspar being most abundant in quantity, and the proportion of quartz exceeding that of mica. These minerals are united in what is termed a confused crystallization; that is to say, there is no regular arrangement of the crystals in granite, as in gneiss, except in the variety termed graphic granite, which occurs mostly in granitic veins. This variety is a compound of feldspar and quartz, so arranged as to produce an imperfect laminar structure. The crystals of feldspar appear to have been first formed, leaving between them the space now occupied by the darker colored quartz. This mineral, when a section is made at right angles to the alternate plates of feldspar and quartz, presents broken lines, which have been compared to Hebrew characters."

4. Section of Wacke, from Bujio Quarry, Panama R. R.

5. Section of Gravel; }
6. Section of Gravel; } From Chagres River, at Gorgona.
7. Section of Gravel, metamorphic; }

Nos. 4, 5, 6 and 7 exhibited by P. H. Dudley.

8. Slides of Heads of Hemiptera, including mouth-parts: exhibited by L. Riederer.

9. A slide of Diatoms from Rembang Bay, 31 generæ, 319 forms, obtained from washings of coral: exhibited by E. A. Schultze.

10. A slide of Diatoms from Santa Monica, 348 forms: exhibited by E. A. Schultze.

11. A slide of Diatoms from the Lystran Deposit, Siberia: exhibited by E. A. Schultze.

12. Hair of *Ornithorhyncus paradoxus:* exhibited by H. W. Calef.

13. Crystals of Salicin : exhibited by D. H. Briggs.

14. Crystals of Hippuric Acid : exhibited by D. H. Briggs.

OTHER EXHIBITS.

15. Section of Amazon Stone ; polarized : exhibited by J. Walker.

16. Scales of *Tillandsia:* exhibited by F. W. Leggett.

17. *Chætophora pessiformis:* exhibited by T. Craig.

OBJECTS FROM THE SOCIETY'S CABINET.

18. Hydraulic Gold, from New Granada, S. A.

19. Hydraulic Gold, from California.

20. Gold Sand, from California.

21. Hornblendic Granite, from Egypt.

22. Granite from New York City.

23. Diatoms, from Lake Superior.

24. *Gyrosigma Balticum*, Port Morris, N. Y.

Meeting of January 20th, 1888.

The President, Charles F. Cox, in the chair.

Thirty-four persons present.

Messrs. C. B. Orcutt and Geo. B. Scott were elected Resident Members.

The President made the following appointments :—

Committee on Admissions : F. W. Devoe, W. R. Mitchell, W. E. Damon, G. F. Kunz, and W. Wales.

Committee on Publications : J. L. Zabriskie, William G. De Witt, E. B. Grove, Walter H. Mead, and J. L. Wall.

On motion, an intermission of twenty minutes was taken to view the exhibits.

After such intermission the President, Charles F. Cox, delivered his Inaugural Address, which is published in this number of the Journal, p. 106.

OBJECTS EXHIBITED.

1. Leaf of *Erythroxylon coca*, bleached and stained : exhibited by E. B. Grove.

2. Mites from June-Bug : exhibited by F. W. Leggett.

PUBLICATIONS RECEIVED.

The Botanical Gazette: Vol. XII., Nos. 9–12 (September–December, 1887); Vol. XIII., Nos. 1, 2 (January, February, 1888).

The American Monthly Microscopical Journal: Vol. VIII, Nos. 93, 95, 96 (September, November, December, 1887).

The Journal of Mycology: Vol. III., Nos. 9, 10, 12 (September, October, December, 1887); Vol. IV., No. 1 (January, 1888).

Entomologica Americana: Vol. III., Nos. 6, 8–11 (September, November, December, 1887, and January, February, 1888).

The Microscopical Bulletin and Science News: Vol. IV., Nos. 5, 6 (October, December, 1887).

Bulletin of the Torrey Botanical Club: Vol. XIV., Nos. 10, 12 (October, December, 1887): Vol. XV., Nos. 1, 2 (January, February, 1888).

The School of Mines Quarterly: Vol. IX., No. 2 (January, 1888).

Transactions of the New-York Academy of Sciences: Vol. IV. (October, 1884–June, 1885).

Anthony's Photographic Bulletin: Vol. XVIII., Nos. 17–24 (September 10–December 24, 1887); Vol. XIX., Nos. 1–4 (January 14–February 25, 1888).

The Microscope: Vol. VII., Nos. 9–12 (September–December, 1887); Vol. VIII., Nos. 1, 2 (January, February, 1888).

The Journal of the Cincinnati Society of Natural History: Vol. X., Nos. 3, 4 (October, 1887, January, 1888).

Bulletin of the California Academy of Sciences: Vol. II., No. 7 (June, 1887).

Proceedings of the American Academy of Arts and Sciences, Boston: New Series, Vol. XIV., Part 2 (December, 1886–May, 1887).

Proceedings of the Newport Natural History Society: 1886–7, Document 5.

Proceedings of the Academy of Natural Sciences of Philadelphia: Part I., January–April, 1887; Part II., April–August, 1887.

Journal of Morphology: Vol. I., No. 1 (September, 1887).

Proceedings of the Natural Science Association of Staten Island: December 10, 1887, January 14 and February 11, 1888.

Proceedings of the San Francisco Microscopical Society: December 15, 1887; and January 12, 1888.

Davenport Academy of Natural Sciences: Proceedings of the Twentieth Annual Meeting, and Address of the President, January 4, 1888.

National Druggist: Vol. XI., Nos. 8, 9, 10, 12 (September 15, October 1, October 15, November 15, 1887); Vol. XII., No. 4 (February 15, 1888).

The Electrical Engineer: Vol VI, No 67–70, 72 (July–October, December, 1887); Vol. VIII., No. 74 (February, 1888).

Rocky Mountain Mining Review: Vol. XVI., Nos. 14, 21, 24, 25 (October 6, November 24, December 15 and 22, 1887).

Mining and Scientific Review: Vol. XX., Nos. 3–8 (January 19, 1887–February 23, 1888).

The Brooklyn Medical Journal: Vol. I., No. 1 (January, 1888).

The Pacific Record of Medicine and Surgery: Vol. II., Nos. 2–5 (September 15–December 15, 1887).

Johns Hopkins University Circulars: Vol. VII., Nos. 60–63 (November, 1887–February, 1888).

The Swiss Cross: Vol. II., Nos. 1–6 (July–December, 1887).

The Hahnemannian Monthly: Vol. XXII., Nos. 10–12 (October–December, 1887).

Psyche: Vol. V., Nos. 141, 142 (January, February, 1888).

The West-American Scientist: Vol. III., Whole Number 29 (September, 1887); Vol. IV., Whole Number 32 (December, 1887).

Indiana Medical Journal: Vol. VI., Nos. 4, 6, 7, 8 (October, December, 1887, January, February, 1888).

The Naturalist's Monthly: Vol. I., Nos. 4, 6 (December, 1887, February, 1888).

Journal of the Royal Microscopical Society: Parts 3–6 (June–December, 1887).

Grevillea: Vol. XVI., Whole Nos. 77, 78 (September, December, 1887).

Nottingham Naturalists' Society. Transactions and Thirty-fifth Annual Report: 1887.

North Staffordshire Naturalists' Field Club. Annual Report and Transactions: 1887).

Bristol Naturalist's Society. List of Officers and Council, 1887; Proceedings, New Series, Vol. V., Part 2 (1886–7).

The Naturalist: Nos. 147–151 (October, 1887–February, 1888).

The Journal of Microscopy and Natural Science: Vol. VI., Part 24 (October, 1887).

The Canadian Record of Science: Vol. II., No. 8 (October, 1887); Vol. III., No. 1 (January, 1888).

The Ottawa Naturalist: Vol. I., Nos. 6–11 (September, 1887–February, 1888).

The Victorian Naturalist: Vol. IV., Nos. 5, 6 (September, October, 1887).

The Indebtedness of Photography to Microscopy. By A. Clifford Mercer, M. D. (Reprint from the Photographic Times Almanac, 1887.)

Method of Staining and Fixing the Elements of Blood. By Alice Leonard Gaule. (Extracted from the American Naturalist, July, 1887.)

O. Schultze's Method of Preparing the Amphibian Egg. By John A. Ryder. (Extracted from the American Naturalist, June, 1887.)

On the New Artificial Rubies. By George F. Kunz. (From the Transactions of the New York Academy of Sciences, October 4, 1886.)

On Two New Meteorites from Kentucky and Mexico. By George F. Kunz. (From the American Journal of Science, Vol. XXXIII., March, 1887.)

Meteoric Iron which fell near Cabin Creek, Johnson County, Arkansas, March 27th, 1886. By George F. Kunz. (From the American Journal of Science, Vol. XXXIII., June, 1887.)

Gold and Silver Ornaments from Mounds of Florida. By George F. Kunz. (Reprint from American Antiquarian, July, 1887.)

Gold Ornaments from the United States of Colombia. By George F. Kunz. Reprint from American Antiquarian, September, 1887.)

Practical Electricity : Vol. I., No. 4 (November, 1887).

The Cosmopolitan : Vol. IV., No. 1 (September, 1887).

Annual Report of the Curator of the Museum of Comparative Zoölogy at Harvard College : 1886–87.

Report of the State Entomologist to the Regents of the University of the State of New York : 1886. (From the 40th Report of the N. Y. State Museum of Natural History.)

Journal of the Elisha Mitchell Scientific Society : 1887.

Schedule of Prizes offered by the Massachusetts Horticultural Society : 1888.

Journal and Proceedings of the Royal Society of New South Wales : Vol. XX (1886).

Monatsblätter des Wissenschaftlichen Club in Wien : Vol. VIII., No. 12 (September 15, 1887); Vol. IX., Nos. 2, 3, 4 (November 15, December 15, 1887, January 15, 1888).

Chronik des Wiener Goethe-Vereins : Vol. II., Nos. 11, 12 (November 15, December 15, 1887).

Jahrbücher des Nassauischen Vereins für Naturkunde, Wiesbaden : Vol. XL. (1887).

Monatliche Mittheilungen des Naturwissenschaftlichen Vereins des Regierungsbezirks Frankfurt a. Oder. Vol. IV. (1886–87).

Jahres-Berichte des Naturwissenschaftlichen Vereins in Elberfeld: Vol. VII. (1887).

Bulletin de la Société Belge de Microscopie : Vol. XIII., Nos. 9, 10, 11 (June 25, July 30, October 9, 1887) ; Vol. XIV., No. 1 (October 29, 1887).

Le Moniteur du Praticien : Vol III., Nos. 9, 10, 11, 12 (September–December, 1887).

Comptes-Rendus des Seances de la Société Royale de Botanique de Belgique : Vol. XXVII., Pt. 1 (November 12, December 4, 1887) ; Pt. 2 (January 14, 1888).

Bulletin de la Société Impériale des Naturalistes de Moscou : Année 1887, No. 3.

Memorias de la Sociedad Cientifica " Antonio Alzate," Mexico : Vol. I., Nos. 4, 5 (October, November, 1887).

Nuovo Giornale Botanico Italiano, Florence : Vol. XX., No. 1 (January 31, 1888).

Fig.I.

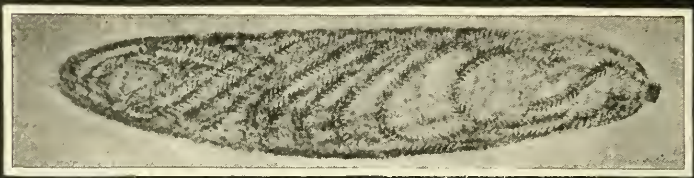


Fig.II.

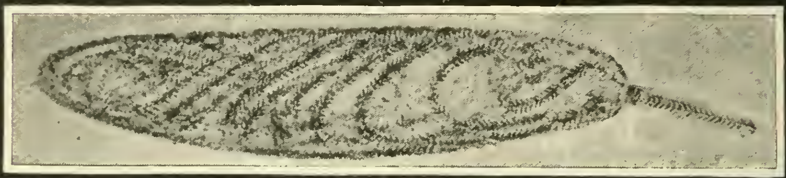


Fig.III.

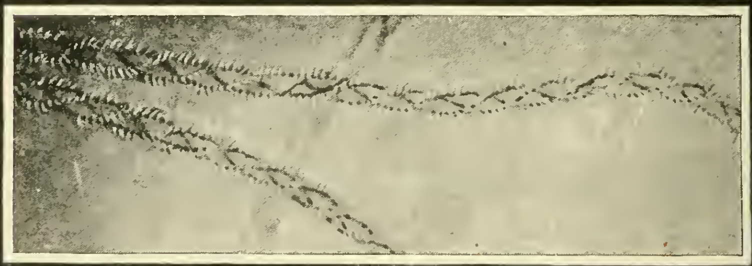


Fig.IV.

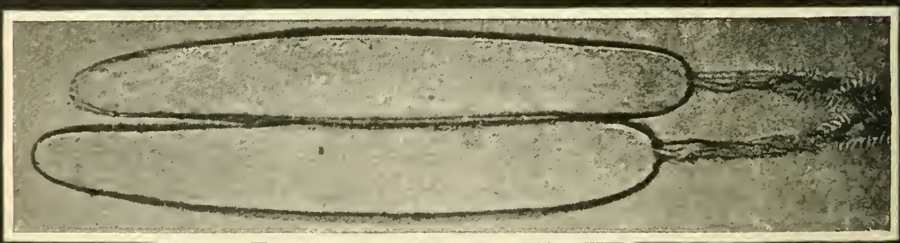


Fig.V.

NEMATOCYSTS OF ISOPHYLLIA DIPSACEA

ALL MAGNIFIED 700 DIAMETERS.

JOURNAL

OF THE

NEW-YORK MICROSCOPICAL SOCIETY.

VOL. IV. JULY, 1888. No. 3.

NOTES ON THE THREAD-CELLS OF CERTAIN CŒLENTERATE ANIMALS.

BY CHARLES F. COX.

(*Read March 2d*, 1888.)

Thread-cells, lasso-cells, filiferous capsules, urticating organs, cnidæ, or nematocysts, as they are variously called, are usually set down as characteristic of the whole sub-kingdom Cœlenterata, although their existence has not been actually demonstrated in every order of either the *Hydrozoa* or the *Actinozoa*. Nor is it certain that they are confined to cœlenterate animals. Prof. Allman claims to have observed the emission of urticating filaments by a species of *Bursaria*, and there is reason to believe that they occur in other infusoria, and perhaps in some annelids. They have been reported to exist likewise in certain naked mollusks, though it is still a disputed question whether in such cases they are not derived from cœlenterate animals upon which the mollusks feed. In general, however, they may be said to be the peculiar property of tentacled animals, and there is good evidence upon which to regard them as organs of offence and defence.

When matured and fitted for their special function, these organs are situated in the outer layer, or ectoderm, and are

Explanation of Plate 12.

FIGS. III., IV. and V., are process reproductions of photographs from nature; Fig. III. showing the cell with the thread partially emitted, Fig. IV. the fully extended thread, and Fig. V. two empty cells with the clear spaces at the bases of the attached threads.

FIGS. I. and II., are modifications of Fig. III., made as diagrammatic representations of the cell before and at the beginning of the extrusion of the thread.

usually collected into reniform groups, or knobs. They are, however, found, in various stages of development, scattered through the deeper tissues and in widely separated parts of the animal. When seen before excitation has caused the ejection of the thread, they consist of a thin-walled sack, either globular in form or of an elongated egg-shape, within which is coiled a long and elastic filament, and which is probably filled by a fluid.

These cells vary greatly in size, in different orders and genera. In the "Ruby Medusa," *Turris Neglecta*, Mr. Philip H. Gosse estimated their length at not over the $\frac{1}{3600}$ of an inch, while in the "Red-lined Medusa," *Chrysaora cyclonota*, he says "the largest were about $\frac{1}{2600}$ inch in length, the smallest about $\frac{1}{5000}$ inch, with the thread occupying an oval cavity about two-thirds of the entire volume." In the tentacle of the "Portuguese Man-of-war," *Physalia pelagica*, which I have under one of my microscopes this evening, the cells average about $\frac{1}{2500}$ of an inch in diameter, and are perfectly circular in outline; but in the "Bermuda Madrepore," *Isophyllia dipsacea*, of which I have a preparation under another microscope, they are all of an oval form, and, in the largest kind, attain to the very unusual magnitude of about $\frac{1}{225}$th of an inch in the longest direction, by about one-quarter to one-fifth of that measurement at the widest part of the short diameter. In some of the *Hydrozoa*, however, and in most of the *Actinozoa* several entirely different sorts of thread-cells occur in the same individual. Thus, in my specimen from *Isophyllia*, I find three quite distinct forms, the largest of which is represented in the drawings. These forms are so unlike in size and construction that it seems beyond doubt that they serve dissimilar purposes in the economy of the Madrepore; but I am unable to say what position they respectively occupied in the living creature.

By far the larger part of all recorded knowledge of thread-cells has been derived from Mr. Gosse's observations, made some twenty-five or thirty years ago. He classifies these organs mainly according to the manner in which the filament is disposed within the capsule. Thus, he describes *chambered, tangled* and *spiral* cnidæ. But, in the three kinds observable in the specimen now under the microscope, the differences extend to the size and shape of the capsule, to the presence or absence of a smaller capsule within the larger, to the way in which the thread

is coiled before ejection, to the dimensions and form of the filament after protrusion, and to the size of the setæ and their mode of arrangement on the thread.

The largest cells are slightly curved, and there is little difference in the size of the two extremities. The point from which the thread is discharged is, however, usually a trifle blunter, or broader, than the other. The thread lies loosely coiled within, filling the whole cavity of the cell, and it is impossible to discover any interior capsule. The anterior end of the thread, which appears to be tipped with a hard point, something like an arrow-head, may be seen distinctly, lying properly directed and ready for emission ; but the posterior end cannot be made out satisfactorily.

The second form of nematocyst is straighter than the first, of a symmetrical oval outline, and about $\frac{1}{500}$th of an inch in length by about $\frac{1}{2500}$th of an inch in width. At the forward end is a tight roll of thread, occupying less than one-third of the narrow diameter of the cell and extending to not quite its middle, whence it is continued, in a loose, irregular mass, nearly to the posterior wall.

The third sort of nematocyst is more egg-shaped and much smaller than either of the other two, being from $\frac{1}{850}$th to $\frac{1}{900}$th of an inch in the longer direction and about $\frac{1}{3700}$th in the shorter. It contains no inner capsule, unless the thread is wound about it and thus conceals it, as may well be the case in any of the three forms under observation. The thread is coiled very tightly at one end and lies in a loose mass at the other, as in the case of the larger cell just described.

In the largest of these cells, represented in Fig. I., with a magnification of 700 diameters, the setæ are easily seen upon the thread before its emission. In the others, however, the parts are too small, and the thread is too closely twisted to permit of our distinguishing the setæ with any power I have had at my disposal.

When these thread-cells are subjected to pressure in the compressorium, a short neck is at first protruded, as shown in Fig. II., and then the thread is emitted from it and forcibly projected to a length many times greater than that which it possessed while enclosed by the capsule. It is not at all clear that the projectile force is derived entirely from com-

pression of the cell. for during and after emission of the thread the capsule retains its oval form, with only a slight narrowing and elongation, as appears in Fig. V. There is therefore ground for the suggestion, which has been made, that the unexcited cell contains a highly expansible liquid or perhaps a mixture of gas and liquid, the expansive force of which is liberated by the protrusion of the neck, above referred to, and the formation of an opening; and I am inclined to believe that the only effect of the exciting cause, whether simple mechanical pressure upon the separated cell or some kind of nervous irritation in the living tissues, is to initiate the explosion by giving vent to the internal pressure of the confined fluid.

It is altogether probable, if not entirely certain, that, after the thread has once been emitted, the end of the nematocyst has been fulfilled and that it is then speedily sloughed off. Other cells must therefore come to the surface, ready for a new discharge of threads. This accounts for the presence of cells in the lower layers of tissue, where they cannot put forth their lassos, but it leaves still unexplained the existence of what are usually regarded as weapons in the walls of the stomach, in portions of the reproductive organs, and in other positions from which it would seem as if they could never reach the ectoderm and come into play against an enemy or an object of prey.

In the specimen from *Isophyllia*, which I now have under the microscope, it is possible to find a series of the largest cells exhibiting various stages in the process of expulsion, from the first movement, shown in Fig. II., to the full extension of the thread, shown in Fig. V. As the thread is seen coiled in the cells, the setæ lie closely appressed, so that the total width is only about $\frac{1}{11000}$th or $\frac{1}{12000}$th of an inch. But, after the thread is completely extended, its diameter, exclusive of the setæ, is about $\frac{1}{6000}$th of an inch and the setæ themselves are about $\frac{1}{12000}$th of an inch in length; so that the thread and setæ together have about four times the diameter they had within the cell.

When the thread is set free by the violent disruption of the cell, it remains of the same size and as closely coiled as it was before; and, after it is shot forth from an unbroken cell, in the normal manner, it exhibits no tendency whatever to resume a contracted form. In other words, the thread is in itself a wholly passive instrument,—a mere missile propelled from its miniature gun, by a power applied to it at the time of its flight.

Now, as to the mode of emission of the thread (or *ecthoræum*, as it is technically called), Mr. Gosse says, with reference to a Madrepore generically related to the one we are examining: "On several occasions of observation on the chambered *cnidæ* of *Cyathina Smithii*, I have actually seen the unevolved portion of the *ecthoræum* running out through the center of the evolved ventricose portion;" and in another place he speaks more particularly thus: "I have offered a conjecture that the projection of the thread is an evolution of its interior, and I believe that it is a complete one through its whole length. I have, even since I wrote that conjecture, seen an example of the process, which I can scarcely describe intelligibly by words, but the witnessing of which left on my own mind scarcely a doubt of the fact. It was effected not with the flash-like rapidity common to the propulsion, but sufficiently slowly to be watched, and *by fits or jerks*, as if hindered by the tip of the lengthening thread being in contact with the glass. In consequence, probably, of this impediment, it took a serpentine, not a straight form, and *each bend of the course was made and stereotyped* (so to speak) *in succession*, while the tip went on lengthening; and the appearance of this lengthening tip was exactly like that of a glove finger turning itself inside out." In the "Standard Natural History" it is said, with reference to the common Hydra, "Now when any stimulus brings a cnidocell into activity, it forcibly ejects the larger part of the tube by a process of evagination or a turning of this part of the tube inside out, as one turns the finger of a glove: this movement is quickly followed by the ejection of the smaller part of the tube in the same manner, by evagination." In Huxley's "Anatomy of Invertebrated Animals," referring to the nematocysts of the cœlenterata generally, it is stated that "the filament is hollow, and is continuous with the wall of the sac at its thicker or basal end, while its other pointed end is free. Very slight pressure causes the thread to be swiftly protruded, apparently by a process of evagination, and the nematocyst now appears as an empty sac, to one end of which a long filament, often provided with two or three spines near its base, is attached."

In these last quotations the use of the word *evagination* is noticeable, because in the one it is employed with a definition which makes very clear what the writer meant, while in the

other the absence of any explanation leaves his intention entirely to the choice of the reader. In fact Prof. Huxley is the only authority with whom I am acquainted whose utterances on this subject are at all open to doubt. All the rest are of opinion that the ecthoræum is turned completely inside out, though the word *evagination*, which some of them use to designate the operation, is defined by Worcester as "the act of unsheathing," which well describes a drawing or pushing of the thread through the sheath or neck which forms at the anterior end of the capsule just before the movement of the thread begins.

If it were not for the drawings which Prof. Huxley gives us in close proximity to the sentence I have taken from his book, I should not hesitate to think that he accepted the prevailing idea, derived from Gosse's observations and descriptions,—particularly in view of his explicit declaration that the filament is hollow. But Huxley's pictures of nematocysts with extended neck and thread are not the traditional representations, and do not seem to be consistent with the traditional theory of introreversion. On the contrary, they appear to illustrate, with regard to one of the *Hydrozoa*, a process of direct propulsion which, I believe, is also demonstrated, in respect to one of the *Actinozoa*, by the specimen which we have under the microscope this evening.

The internal capsule, which is visible in many of the unexploded nematocysts of the smaller forms, disappears when the thread is emitted, and I think it is turned inside out and then forms the neck of the bottle-shaped cell, and that through it the thread is shot. I feel confident that the eversion of the neck is all the turning inside out that takes place in any of the thread-cells of Isophyllia, and that the thread itself goes straight forward. It is probable that, if one could see the movement of the thread immediately after the eversion of the neck, it would be correctly described in the words used by Mr. Gosse when he said he had "seen the unevolved portion of the *ecthoræum* running out through the centre of the evolved ventricose portion;" for of course, at that stage of the operation, he could not tell whether there was any connection or not between the enveloping neck and the enclosed swiftly gliding thread. Mr. Gosse is an accurate observer, and I do not question his statements of what

he actually saw; but his interpretations of his observations are not the only ones of which the facts are capable.

After the thread is fully extended there remains at its base a clear space, devoid of setæ, about equal in length to the shorter diameter of the cell, which is shown in Fig.V., and which I believe to be the everted tube, or neck, above referred to. This I take to indicate that the thread runs out to the extreme point of the neck, where it is checked and held by some formation at the posterior end of the thread which acts as a wedge, or jam, in the mouth of the tube, making an invisible joint and producing an appearance as if the tube and the thread were actually continuous.

But the nematocyst pictured in Fig. III. affords us very strong and unexpectedly striking proof that the thread is simply pushed forward and not turned inside out, in the arrangement of the setæ upon the thread as seen both within and without the capsule. We know that whatever slant the setæ have upon a wholly emitted thread is backwards, and we observe that the setæ upon the partly extended thread in Fig. III. have this same inclination. We perceive, however, that there is no difference in the direction of the setæ upon that portion of the thread which is still within the capsule, as there certainly would be if the thread were being turned inside out. If a tube covered with hairs were being thus treated, the hairs would not only have opposite positions upon the two reversed sections of the tube, but upon the everted portion they would be exterior and upon the unturned part they would be interior to the tube. If, therefore, the thread in Fig. III. were being ejected in the manner described by Mr. Gosse, all the setæ within the cell should be on the inside of the thread, whereas they are clearly and unmistakably on the outside, like those already without the cell.

Having made up our mind, then, that the thread is merely driven through the neck of the bottle-like cell, it remains for us to inquire what part the setæ perform in this curious, but comparatively simple operation. This brings us to consider their form and their mode of arrangement on the thread. Because of the minuteness and delicacy of these really bristle-like appendages, the best qualities of our modern objectives are required to discern their character with any degree of certainty. It is not strange, therefore, that at one time the threads of certain

cœlenterate animals were described as wholly smooth, which are now known to be clothed with very fine hairs, and that others were said to be merely serrate, which better lenses now prove to be setaceous. If the largest threads are to be taken as typical of the whole class, the general disposition of the setæ upon the thread is in spiral lines. According to Mr. Gosse's description of the ecthoræum of *Tealia crassicornis*, "the screw is formed of a single band, having an inclination of 45° to the axis;" while in *Sagartia parasitica* "we find a screw of two equidistant bands. * * * having an inclination of 70°;" and "in *Cyathina Smithii*, the *strebla* is composed of three equidistant bands, * * * with an inclination of about 40° from the axis." The threads from the largest cells of our *Isophyllia* (shown in Fig. IV.) correspond with those last described by Mr. Gosse, in respect to the number of the spiral lines, as I suppose we might expect from the relationship of the two genera.

It has generally been assumed that the setæ serve the same purpose as does the barb of an arrow or a spear,—namely, of fixing the weapon in its wound. But this inference is somewhat weakened by the fact, in the first place, that many organisms which possess thread-cells manifest very little or no power of stinging; by the further fact that the same organism is often provided with several different kinds of thread-cells, apparently adapted to more than one office, and sometimes located in parts of the animal which cannot be brought into use offensively; and, finally, by the fact that the setæ are not always situated upon a part of the thread likely to penetrate, or which would even reach, the integument of an animal attacked,—an exception which is exemplified by the narrow band of long hairs placed near the base of the filament of the smallest cells of *Isophyllia*, which are confined to a space of only about $\frac{1}{400}$th of an inch, from which to its tip the thread appears to be smooth. Taking all these things into account, and considering also the analogies of the case and the collateral circumstances to which I have already referred, I am of the opinion that the main purpose of the setæ, instead of being similar to that of the arrow-barb, is rather like that of the "feather" on the dart of the air-gun, or, perhaps more exactly, like that of the piston-head in the cylinder of the steam engine;—for I take it that the setæ fill out the neck-like tube of the nematocyst and receive the impact of the propelling force applied from within the cell.

THE MICROSCOPICAL INVESTIGATION OF ROCKS. A PLEA FOR THE STUDY OF PETROLOGY.

BY DR. H. HENSOLDT.

(*Delivered April 20th*, 1888.)

Mr. President, Ladies and Gentlemen :—

It is not without reluctance that I have accepted the invitation to deliver this address, because the subject is not altogether, a popular one. I have often wondered why there are so few in the ever increasing army of microscopists, who take an interest in the microscopical investigation of minerals and rocks, and why there are fewer still, who have selected this department as their special field of study.

Of course I am aware that this army is mainly composed of amateurs. They do not lack the ability, but, in nine cases out of ten, they have not the time necessary for thorough and methodical work. Yet among these very amateurs we find a large number of enthusiastic workers, who, in spite of all drawbacks, accomplish wonderful things, make original discoveries, and lead the way to entirely new fields of microscopical research.

Now it may be doubted whether within the whole range of practical microscopy there is a subject which so well repays study—a subject so eminently calculated to afford pleasure and satisfaction to the lover of the microscope as the investigation of the minute structure of minerals and rocks. It is questionable whether the whole field of zoology and botany, in fact the entire organic division of nature can present to the inquirer a greater complexity of forms, a more wonderful display of colors, a more startling array of problems—problems strange and fascinating in their mystery—than this neglected world of stones.

Here we have a field as yet almost untrodden, and affording endless opportunities for research to an army of workers. We all know what the proboscis of the blow-fly looks like. When we are about to examine it under the microscope we know exactly what to expect—we have seen it before, and could

describe or draw it at any moment. But we do not know what to expect when we come to examine a thin section of granite. We may have seen hundreds of sections of granite before, yet, even if we had seen thousands and tens of thousands, this would not warrant us to draw any conclusions as to the appearance of the specimen in question. For the chances are a thousand to one against our having ever seen anything like it.

There are no two granites alike, just as there are no two lavas, basalts, or other igneous rocks alike. The differences in their microscopical structure are perfectly astonishing, especially in specimens of the same kind of rock from different localities. But even different pieces of granite from the same locality may present an almost infinite variety of structural detail. And of twenty sections from one small piece, not larger than a walnut, not two will be found alike. The only kinds of rocks which exhibit a close resemblance, even if taken from different localities, are certain fine-grained sandstones, slates and other sedimentary formations; and even these, if carefully examined, will be found to show marked differences.

The conclusions, which such variations and differences enable us to draw, do not affect the life-history of some obscure insect, or the derivation of a fungus, but involve cosmic problems of universal importance ; the history of the crust of our planet, cycles of marvellous changes in the abysmal ages of the past, the disintegration and re-formation of the earth's material, and the life of those extraordinary and mysterious bodies, the crystals.

The time is fast approaching, when the microscope will be as indispensable to the progressive geologist, as it has been already, for a considerable number of years, to the zoologist, the botanist and the physician. Indeed, even at the present moment, the foremost inquirers in some of the most important departments of geological science depend so much on the aid of the microscope in their researches, that they would be almost helpless without it. If that instrument has vastly added to our knowledge of vegetable or animal structure, if it has enlarged our horizon to an immeasurable extent in the domains of the organic world, it is accomplishing at present equally important results in the domain of inorganic nature, for it has completely revolutionized the study of rocks. Some of the facts which have already been

demonstrated by the microscopical investigation of rocks border on the marvellous.

Minerals may be termed the individuals of the inorganic world. Each has its characteristic features or properties, which distinguish it from every other mineral. Quartz, feldspar and mica, separately considered are minerals ; but, when occurring in a state of mixture, they constitute a true rock—granite. And it is the determination of these minerals, and of the conditions under which they assumed the forms in which we now find them, which is the chief aim of microscopical petrology.

Thirty years ago, the only optical apparatus, employed by geologists for the examination of rock-specimens, consisted of an ordinary pocket-lens, with a magnifying power of from four to fifteen diameters. This was deemed quite sufficient for all ordinary requirements, and some even disdained the use of magnifying glasses altogether. Specimens were only examined externally. It was noted what kind of appearance a freshly broken surface presented ; whether the specimens were rough or smooth, coarse-grained or the reverse; what kind of odor they emitted when breathed against; how they felt to the touch; whether they yielded to the scratch of a piece of iron or the finger-nail—in fact, the tests, which were deemed sufficient in those days, appear quite ludicrous in the light of modern achievement.

To Prof. Sorby, still living in England, is due, in a great ex-measure, the credit of having first pointed out the fact that a vast deal of information can be obtained from a microscopical investigation of rock-specimens. Indeed, he may be called the father of modern petrology. It occurred to him to prepare thin slices of rocks, reducing them by grinding and other processes to a state of extreme thinness, so as to render them more or less transparent. These he mounted in Canada balsam on glass-slips, and placed them under his microscope, applying magnifying powers of from 40 to 700 diameters.

The result surpassed his most sanguine expectations. Dull and shapeless stones, some picked up by the road-side, and presenting to the naked eye nothing but a uniform tint of gray, black or dirty-red, transformed themselves under the microscope into fields strewn with beautiful crystals of wondrous colors and forms, or literally blossoming as the rose. Every component

mineral could be distinguished by the form, color, etc., of its crystals, and it was found that even the most fine grained rock was not, as formerly believed, a mixture of shapeless ingredients, but consisted of minute crystals, sometimes of the most exquisite outlines.

Especially striking and lovely is the appearance of many of the volcanic or igneous rocks, when reduced to thin sections, and examined under the microscope. The dullish green lava, called pitch-stone, which is found in dykes on the isle of Arran, on the west coast of Scotland, exhibits under the microscope whole forests of fern-trees, garlands, leaves and flowers of marvellous magnificence. A certain granite from Cornwall contains needle-shaped crystals of tourmaline, radiating star-like from a common centre. Basalts, obsidians, porphyries, serpentines from various localities show labyrinths of multicolored crystals, resembling rows of pillars, turreted castles and fairy caves, glowing in all tints of the rain-bow.

The sedimentary or stratified rocks, while they cannot equal under the microscope their plutonic rivals, in brilliancy of color or gorgeousness of crystalline display, make up this deficiency by other features of interest, compensating the inquirer by revelations of a different character, but none the less remarkable.

Many marbles and limestones are found to be literally composed of foraminifera, the tests of rhizopods, resembling tiny shells of the most delicate and beautiful forms, which were deposited on the ancient sea-bottoms, accumulating in the course of ages to a height of hundreds, nay, thousands of feet, every inch of which represents at least several centuries. Thin sections of almost any piece of flint exhibit under the microscope quite a little world of curious organic remains, such as sponge spicules, xanthidia, small fragments of coral, and the foraminifera already mentioned, furnishing very strong evidence that the flints are silicified fossil sponges.

It would be in vain for me to attempt here anything like a detailed description of the discoveries, which have resulted from the microscopical examination of rocks. This branch of study, though barely thirty years old, has already contributed such a vast deal of new information to natural science, that it has, in

more than one respect, revolutionized our old-fashioned conceptions of geological research.

A number of very excellent works have been published by eminent specialists, notably Germans, such as Rosenbusch, Zirkel and others ; but, like most works of the kind, they are too dry and technical to attract or to satisfy the amateur, who wants something explicit and popular to make a study pleasant. These books take too much for granted, and presuppose knowledge which not one in a thousand, of even well-educated persons, is likely to possess. They invariably assume that the reader has a thorough knowledge of crystallography, a subject full of complexities and difficulties, and abounding in puzzles sufficient to try the patience of a Job. They also expect the student to be well acquainted with optics, especially that most difficult and exasperating branch, which relates to the polarization of light, and the chromatic phenomena presented by crystals under crossed Nicol-prisms. Of all subjects difficult to understand, this last is the worst, and the explanation of it generally given in books leaves one more bewildered than instructed. It took me over two years to penetrate the mystery, and now I find that I can explain in a quarter of an hour what has taken me so long to learn.

What is wanted is a popular work, consisting of two parts ; the first to give a clear and intelligible account of crystallography, optics and other necessary or desirable preliminary information; the second, to treat of the structure of rocks, the whole to be written in as light and attractive a manner as the subject permits, and to take as little for granted as possible. I am perfectly aware that such a book would necessarily lack in thoroughness and completeness, but to the beginner it would be of incalculable value.

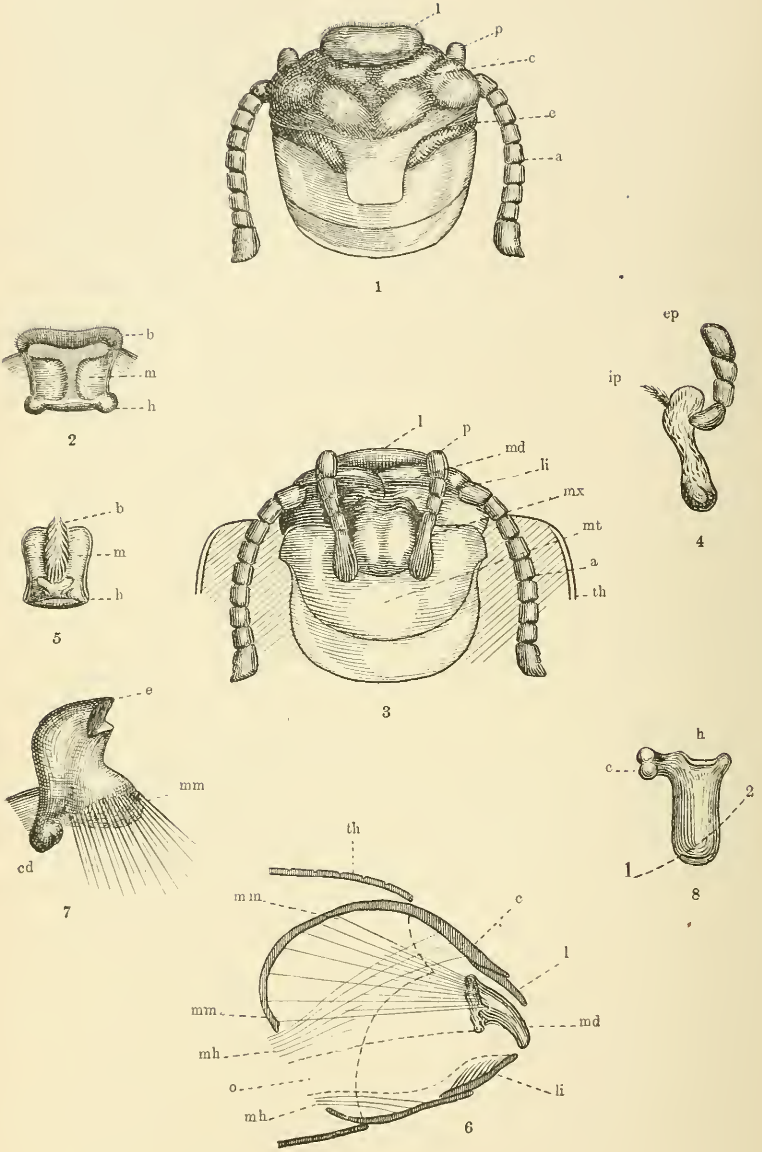
Rutley's work, "The Study of Rocks, an Elementary Text Book of Petrology," contains much useful information, and is a very good book for a beginner; but what it says on crystallography and the phenomena of polarization is altogether too short and fragmentary.

But let those of you, who have a mind to enter the field of microscopical petrology, who have a general desire to join the ranks of workers in this very attractive and interesting de-

partment, take consolation in this: it is not by any means absolutely necessary to be intimately acquainted with the intricacies presented by the world of crystals, or the phenomena of polarization in order to take up this study. If you can master these things, if you can lift the veil of Isis, so much the better for you, so much the greater the enjoyment which you will derive, so much the more will you be enabled to accomplish for science. But you may do a great deal without these things. Many, if not most of the minerals, of which a rock is composed, may be determined without a detailed, or even general knowledge of crystallography, and it is not always, or even generally necessary to resort to the polariscope in order to identify the constituents of a rock. Happily, a number of other features, which are quickly learned and easily remembered, help us in our investigation, and it is almost needless to add that before long even those formidable subjects, crystallography and polarization, lose much of their grim aspect.

You will then be able to determine at a glance the principal rock-forming minerals which you behold in a thin section, and you will then also find that the microscopical investigation of rocks affords you, in the endless variety of forms which it presents, in the gorgeousness of the colors which it reveals, in the wealth of its unsolved problems, a greater, richer and fuller field for study than any of the old and well-beaten paths of animal and vegetable morphology.

Even the general microscopist, the mere onlooker or collector of specimens, might turn with advantage to this subject. It will furnish him with some of the loveliest objects within the whole domain of practical microscopy, and will open up to him one of the most enchanting prospects in the wonderland of science.



ZOPHERUS MEXICANUS, SOL.

THE BEETLE, ZOPHERUS MEXICANUS, SOL., CUTTING METAL.

BY F. W. DEVOE.

(*Read May 4th*, 1888.)

The beetle, to which your attention is directed, is *Zopherus mexicanus*, Sol., a native of Central America, where it is popularly known as "Makeche." Specimens average in length from 4.5 to 5 centimetres, and in width from 1.5 to 2 centimetres. The thorax and elytra are yellowish gray, this color being due to a coating of scales, which may be scraped away, when the underlying normal black color will appear. The dorsal surface is marked by many knobs arranged in lines, and more prominent in the middle than at the sides. The general color of the under surface and of the legs is black, but this is more or less concealed in numerous places by the yellowish scales before mentioned. The head is retracted as far as the eyes into the pro-thorax. The antennæ are nine to eleven jointed, the outer two or three joints being connate, and, when at rest, the antennæ lie in two deep grooves on the under surface of the pro-thorax.

The character is indicated by the structure. A slow, deliberate walker—it never flies, for its hind wings are not developed, and it never hurries. A lover of darkness—it

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Explanation of Plate 13.

FIG. 1.—Dorsal aspect of the head of *Zopherus mexicanus*: ***l***, labrum ; ***p***, palpus ; ***c***, clypeus ; ***e***, eye ; ***a***, antenna.

FIG. 2.—Inner face of the labrum : ***b***, fringing bristles ; ***m***, insertion of muscles ; ***h***, deep hinge, with insertion of muscles, joining to clypeus.

FIG. 3.—Ventral aspect of the head : ***l***, labrum ; ***p***, palpus ; ***m d***, mandible ; ***l i***, labium ; ***m x***, maxilla ; ***m t***, mentum ; ***a***, antenna ; ***t h***, thorax.

FIG. 4.—Ventral aspect of the left maxilla with its palpi : ***e p***, external palpus ; ***i p***, internal palpus.

FIG. 5.—Inner face of the labium : ***b***, bristles of tongue-groove ; ***m***, insertion of tongue muscles ; ***h***, hinge, connecting the labium with the mentum.

FIG. 6.—Longitudinal-vertical section of the head : ***th***, thorax, ***c***, clypeus, ***l***, labrum ; ***m d***, mandible ; ***l i***, labium ; ***m m***, ***m m***, muscles of the mandible ; ***m h***, ***m h***, muscles, moving the head on the thorax ; ***o***, œsophagus.

FIG. 7.—Ventral aspect of the right mandible : ***e***, cutting edge ; ***c d***, double headed pivot, or condyle ; ***m m***, insertion of the muscles.

FIG. 8.—External, lateral aspect of the right mandible : ***h***, the hinge ; ***c***, the condyle ; ***1***, ***2***, direction of cutting movement.

dwells in the woods, hidden under the bark of trees, in canes, or in chips left by the wood-cutter. Strong jawed it goes its way.

Much has been said regarding the strength of insects, and especially of beetles. It has been asserted that they have made their way through sheet-lead (*Hylotrupes*), and even through iron pipes. Fortunately I have been able to watch this beetle while engaged as a metal-worker, and to learn something of its powers.

My first specimen was from Yucatan, presented to me last summer by a friend from Mexico. It was contained in a card-board box, which I enclosed in my desk over night. The next morning I found the creature had eaten a large hole in the side of the box, and was enjoying its liberty with a commingling of deliberation and satisfaction. Having recaptured it I placed it in a small glass jar, to which I fitted a cover of wood, after boring a few holes in the latter for ventilation. The next day I found on the bottom of the jar numbers of chips of the Black Walnut wood of the cover. I then substituted the metal cover, which belonged to the jar, after punching through the metal several holes, about three-eighths of an inch in diameter, and supplied the captive with some sugar.

About one week after this I left home for a day, and, when I returned, I found that the beetle had cut out in small bits all the metal between two holes in the cover, and through this enlargement had thrust out its pro-thorax, in such manner as to give evidence that if left alone it would soon regain its liberty. This work upon the metal was all done within the space of forty-eight hours. Upon examination, the cutting edges of the mandibles appeared to be unbroken, and in perfect condition. About three weeks after this time this beetle died.

Several attempts were made during the winter to secure some more living beetles of the same species. But they all died before reaching New York. About a month since, however, I had the good fortune to receive two lively specimens. These were

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Explanation of Plate 14.

Fig. 1.—The metal cover, showing the enlargement between two holes, made by the beetle.

Fig 2.—Edge of this enlargement, grooved by the mandibles, magnified 10 diameters.

Fig. 3.—View of the metal chips, magnified 10 diameters.

FIG. 1.

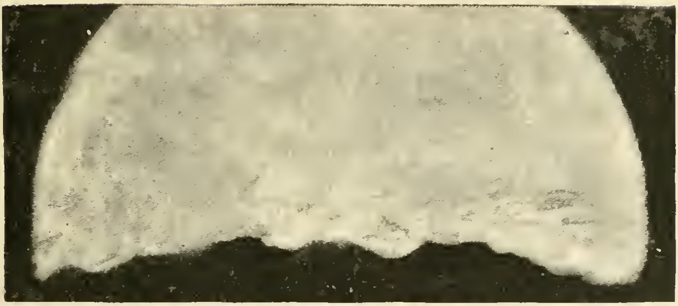

FIG. 2.

FIG. 3.

ZOPHERUS MEXICANUS, SOL.

placed in glass jars, like that just mentioned, fitted with their respective metal covers.

One of these beetles I exhibit here alive to-night. This one has accomplished metal-working precisely like that of the first specimen, and I have had no little satisfaction in watching the process, and in listening to the sound, caused by the mandibles while cutting the chips from the cover. During this operation the beetle passed the feet through the ventilating holes, and hung suspended, back downwards, from the under surface of the cover. This metal is pewter; probably composed of three parts of lead, and one part of tin, and is about one thirty-second of an inch in thickness. Under experiment it was found that a force of 369 grammes was necessary to remove chips corresponding to those cut by the beetle.

Your attention is called to the fact that the cutting edges of the mandibles of the dead beetle are in good condition, while those of the living beetle are badly broken. Both insects did the same kind of work, under the same circumstances; but I am unable to account for the different effects upon the tools they employed.

THE LARVÆ OF THE STAG-BEETLE, EATING RAILROAD TIES.

BY PROF. SAMUEL LOCKWOOD, PH. D.

(*Read May 4th*, 1888.)

On the 28th *ult.*, I received some old ties, which, to be replaced by new ones, had just been taken up from the track of the Pennsylvania Railroad, where it passes through the village of Freehold, New Jersey. They were of oak, and measured eight feet and six inches in length, with an average thickness of about seven inches. The ties being hewn and not sawed, the width varied a great deal, depending on the age of the trees employed.

These old ties were purchased for the purpose of building a barricade. I noticed that while the under and the upper surfaces were sound, the sides were dozey, or decayed. Wishing to know the depth of this condition of the wood I used a chisel, and found numbers of the larvæ of a lamellicorn beetle, each

one more or less curved, and lying in a groove, which it had made by eating the softened wood down to the solid part. The decay was caused by a fungus. And even at the solid part of the wood, or bottom of the burrow made by the insect, the wood was already softening under the continued action of the fungus.

There was thus an interesting combination of labor between both parasites—the larva and the fungus. Similarly the Red Man, who once occupied these parts, had his own way of making a dug-out canoe. After plastering the sides of the selected log with clay, a fire could be made on the uncovered part, and the charred, or burnt portion, to the depth of a small fraction of an inch, could then be removed with a stone adze, and fire again applied, and the process repeated. It was even thus with these ties. The mycelia, or fungoid roots softened the woody tissues, and these were excavated by the cutting or gouging jaws, and so passed into the stomach of the larva, which all the time kept moving along, and furnishing the fungus a new surface for its operations.

The road-master took up forty-eight ties in the village, replacing them with new ones. All these were delivered at my house. Everyone was attacked by fungus and larvæ, in the manner here described, throughout the entire length and surface of its two sides ; while the flat, hewn surfaces, above and below, were not attacked. The larvæ were present in great numbers. I have some here in alcohol ; also a specimen of each sex of the imago, or perfect beetle.

As to the extent of the mischief done :—as mentioned, not an inch of surface of the sides escaped, and the depth of the timber thus consumed was from an inch and a half to three and a half inches. If we should call it an average of two and a quarter inches, as these ties were eight feet and six inches in length, and averaged fully seven inches in thickness, we should have, in round numbers, one hundred and nineteen cubic feet of oak thus eaten up on forty-eight ties.

It is a question now ; how long did it take to accomplish this ? As to the time occupied by the fungus, the data are lacking. I think, however, we are better off in respect to the time taken by the larvæ. It was my good fortune to determine the length of time required by the larvæ of the Goldsmith Beetle, *Cotalpa lanigera*, to attain, from the egg, the imago state. I found this

to be three years. According to Rözel, the European *Lucanus* takes six years. My long-continued observations of the larval growth of *Cotalpa* gave me a capacity of determining their respective ages among a mixed number of larvæ of different sizes.

You may notice that these larvæ of *Lucanus*, which I have in alcohol, are of three quite distinct sizes. I regard the largest as three years old, and the smallest but one year. The mischief accomplished, therefore, in this combination of insect and fungus has been done, I think, in three years. But the most startling facts are these. Here is shown, to put it in business form, the existence of four contracts, or agreements to attack these railroad ties—the one-year larvæ having five years to run, the two-year larvæ four years, and the three-year larvæ three years; while the fungus, the most insidious of them all, has a license of indefinite duration ; or, omitting metaphor, unlimited opportunity for mischief, simply requiring the one condition—dampness.

There is also an interesting bit of negative testimony here. After long searching, I did not find one pupa. And it is certain, that, as the imago appears in June, none of the larvæ, even the oldest, had time to pupate for an imago of this year. Moreover, this passing from the active, feeding state of the larva, into the sleeping, pupal condition, occurs when the summer is over. Hence it is certain that *Lucanus dama* at three years has not even reached the pupal state.

An interesting fact too is this versatility of habit. The mother stag-horn deposits her eggs in decayed spots in oak and other trees, as they stand in the forest. In this instance the insect does its work in timber, laid in position and partly sunk into the ground ; over which, at the very season of the ovapositing, namely the summer, immense trains are passing at intervals of but a few minutes. And even in the night, at which time the insect probably deposits her eggs, the trains are almost hourly, as the freight then has its opportunity. As respects the larvæ too, one would think the action of the passing trains would be against their welfare.

I regret my inability at this writing to find the fungus in fruit, hence I cannot even hint as yet at its species.

PROCEEDINGS.

Meeting of February 3d, 1888.

The President, Mr. Charles F. Cox, in the chair.

Thirty-four persons present.

Dr. Fred. A. Mandeville was elected a Resident Member of the Society.

The President suggested the designation of some particular class of objects for exhibition at particular meetings, and also desired the members to hand in to himself, or to the Recording Secretary, a list of objects, such as they would exhibit, and from which a selection might be made as needed.

OBJECTS EXHIBITED.

1. Radula of Marine Snail, *Ilynassa obsoleta*, Stim.; by J. L. Zabriskie.
2. Woody fibre, found in a Termite's nest, from Colon, South America: by P. H. Dudley.
3. Section of Rhubarb root, *Rheum officinale*, showing crystals of calcium oxylate: by E. B. Grove.
4. Section of Limestone, from Indiana: by James Walker.
5. A slide of 88 Diatoms; arranged by C. L. Peticolas: by C. S. Shultz.
6. Mouth-parts of *Cantharis Nuttallii*, and also a dissection of the spiracles, with the tracheæ attached: by L. Riederer.
7. Section of Fortification Agate; polarized: by J. D. Hyatt.
8. Transverse section of stem of Papyrus, from the Nile: by H. W. Calef.

OBJECTS FROM THE SOCIETY'S CABINET.

9. Polycystina, from Barbadoes.
10. *Rhabdonema arcuata*, from the "Kills," N. Y.
11. Gold Crystals, from White Bull Mine, Oregon.

WOODY FIBRE, FOUND IN A TERMITE'S NEST.

In the absence of Mr. P. H. Dudley, a communication from

him, explaining his exhibit, was read from the chair, as follows :

"The slide of woody fibre, or pulp, prepared from a fragment of a Termite's, or White Ant's, nest, from Colon, is of special interest.

"The wood has been so thoroughly comminuted, that it is doubtful whether it could be recognized as woody particles under the microscope, unaided by chemical reagents.

"A study of similar slides throws some light upon their work of destruction on many kinds of wood, in structures.

"The particles of wood do not have as sharp, angular corners as one would naturally expect of chips cut from solid wood; on the other hand, they seem as though made from softened wood, or that undergoing decay. The particles have more the appearance of little pellets than cuttings. which in some measure is doubtless due to the form, motion and pressure of the mandibles. After they are cut the next step is not clear. Some cuttings serve as food for the insects, as they are found in the alimentary canal. Others are mixed with some substance which causes the particles to adhere, and then are fashioned into the walls, which form the galleries of the nest.

"The walls are built up of a number of thin layers of the cuttings, give evidence of being prepared with great care, and become quite hard and solid. A fragment thrown into water does not disintegrate by soaking, and after many hours it requires trituration to separate the particles.

"On burning a piece, nearly all of the substance is consumed; the residuum, however, being much more than the natural ash of the wood—some clay is present. Phloroglucin gives a reaction, showing some lignin is still in the woody particles. In many of the specimens I found fragments of the mycelium of a fungus, and upon examining the stick of yellow pine, 6 x 12 inches, which contained the nest, found it was in process of decay at the point of attack.

"The rainfall at Colon is over eleven feet *per annum*, and many species of wood, in the form of lumber, absorb and retain much more moisture than the same kind of lumber contains here ; consequently the fibres are much softer. Several specimens of white ash furniture were shown me, of which the boards had been completely tunnelled by the Termites. They

give no evidence on the exterior of the destruction they have made in the interior of the timber or lumber. Some writers have stated that the Termites often fill in with clay the timbers needed for strength of the building. I only found the cuttings of the wood repacked, mixed with the same substance as that used in forming the nests.

"The only exterior evidence of the Termites in a building will be the little covered gallery, about three-eighths of an inch wide, and one-fourth of an inch high, which they run up the walls or posts. In this little passage-way the ants go back and forth.

"Undoubtedly exaggerated stories have been told and written about the Termites destroying all kinds of wood. On the Isthmus, hard woods are not attacked until decay has softened the wood-fibres. It is but proper to say that woods decay there much faster than here, the conditions for the growth of fungi being continuous; while here, in out-of-door structures, they are interrupted by the winter. In many of the large buildings, which could not be well protected from the dampness of the climate, the timbers of the roofs decay, and are eventually attacked by the termites. The roof timbers of the church, built by the Panama Railroad Company, have just been examined and found to be completely tunnelled by the Termites."

Mr. James Walker donated the slide exhibited by him to the Cabinet of the Society.

Meeting of February 17th, 1888.

The President, Mr. Charles F. Cox, in the chair.

Thirty-one persons present.

Mr. Alfred Pell was elected a Resident Member, and Mr. Marshall D. Ewell was elected a Corresponding Member of the Society.

OBJECTS EXHIBITED.

1. A selected group of *Astromma Aristotelis* (one of the *Polycystina*): by George B. Scott.

2. *Tubularia larynx*, L. (*Cœlenterata*): by L. Riederer.

3. *Eudendrium ramosum*, L. (*Cœlenterata*) : by L. Riederer.
4. Pinna of Fern, *Trichomanes lucens:* by E. B. Grove.
5. Radula of *Crepidula fornicata*, Lam.: by J. L. Zabriskie.
6. Pollen, on anther and stigma of *Abutilon roseum:* by Frank Healy.
7. Pollen, on anther and stigma of *Althæa officinalis :* by Frank Healy.
8. Skin of Chameleon : by J. D. Hyatt.
9. Section of Fossil Coral (Siliceous): by J. D. Hyatt.
10. Section of Fossil Wood (Siliceous): by J. D. Hyatt.
11. *Pleurosigma angulatum*, by oblique light : by E. J. Wright.

HYDROMEDUSÆ.

Mr. L. Riederer, in explanation of his exhibit, read the following note :

" *Tubularia larynx*, L. and *Eudendrium ramosum*, L. are two *Hydromedusæ*. They belong to the *Cœlenterata*, or *Zoophyta*. The *Hydromedusæ* are marine ; only one of them, *Hydra*. lives in fresh water. The single animal forms a cup, fastened by one end to a stem ; at the other end is a mouth-opening, surrounded by retractile tentacles, numbering four, six, or their multiples. The mouth opens directly into the stomach, or gastrovascular space. By a tube through the stem, filled by the food-juice for the entire colony, there is a communication between all the animals on one stem.

" The animal consists of two distinct layers of cellular tissue; the inner, or endoderm, and the outer, or ectoderm. On the distal parts of the tentacles there are found, in large numbers, cells, or nematocysts, furnished with nettles, or stinging threads. The slightest touch causes these cells to burst, and the fine threads contained in them are forcibly thrown out. By this means small animals, their principal food, are paralyzed and killed. Some of the larger species of *Cœlenterata* give rise to a painful nettle-rash, when their tentacles come in contact with the human skin.

" Some animals of this family have highly differentiated cells, acting as sensories for feeling, hearing and seeing.

" The single polypes on one stem are not always similar.

Some are employed only in procuring food, the tentacles pushing the prey, maimed by the nettles, into the mouth. Others produce separating buds, furnishing the principal means of propagating the species. But also medusoid gemmæ are formed, which swim around, resembling free medusæ ; and only after passing through this kind of a larval stage do they settle again to become polypes."

THE FERN, TRICHOMANES LUCENS.

Mr. E. B. Grove, in explanation of his exhibit, said :

" *Trichomanes lucens* belongs to the *Hymenophyllaceæ*, or filmy ferns. It has very delicate and translucent fronds, seemingly of a lace-like character. The involucres are goblet, or funnel-shaped, and are formed on the ends of each of the pinnæ of the fertile fronds, and at the end of a vein. The vein penetrates the involucre, and, dividing into thread-like filaments, bears the spore-cases.

"The specimen was bleached in a solution of chlorinated soda, stained with iodide-green, and mounted in balsam."

Mr. Grove also mentioned his method of removing air-bubbles from balsam mounts, viz., employing a very minute alcohol flame, applied to that portion of the slide where the bubble is situated, and, as soon as the bubble begins to expand, following it up with the flame to the edge of the cover.

SKIN OF THE CHAMELEON.

Mr. J. D. Hyatt, in connection with his exhibit of the cast skin of the Chameleon, reviewed the theories proposed in the past to account for the remarkable changes of color accomplished by the animal. He stated that the skin was covered with minute papillæ, conical and hollow, composed of thin scales, which rendered them rather nacrous in structure.

In the specimen under the microscope the color depended upon the angle upon which the light struck these prominences, and,by swinging the mirror from the extreme right to the extreme left, there would be caused a variation from a dull red to a green. The same result would be attained if the animal possessed the power to elevate and depress the papillæ, so that the

light would strike upon them at different angles. Allowing that the animal has this power, the explanation is complete.

Mr. Hyatt also stated that he kept the animal, which furnished the specimen of cast skin exhibited, alive in a cage, and that it gave no evidence of change of color corresponding to that of the object upon which it might be resting; but showed a red color when displeased, and a green color when pleased, as in the act of receiving food.

The Rev. K. F. Junor, called attention to a cuttle fish, in which the change of color is caused by the transference of a fluid, contained in the skin, from a lower to a more superficial layer of pigment-cells, or *vice versa*.

Mr. L. Riederer also mentioned the frog, in whose skin a change of color is occasioned by contraction of pigment-cells.

Annual Reception of 1888.

The Tenth Annual Reception of the Society was held at Lyric Hall, 723 Sixth avenue, on the evening of February 24th, 1888.

The large hall was filled with an apparently interested and gratified audience, and the occasion was enlivened by music, furnished by an excellent orchestra.

Fifty-two objects were displayed and explained by forty exhibiting members.

The objects exhibited were as follows :—

1. Meteoric Diamonds : by George F. Kunz.

2. *Peridotite*, var. *Kimberlite*, Lewis, from Elliott Co., Kentucky : by George F. Kunz.

3. *Peridotite*, var. *Kimberlite*, from Kimberly, South Africa : by George F. Kunz.

4. *Utricularia neglecta*, an insectivorous aquatic plant : by George S. Woolman.

5 and 6. *Trichina spiralis* : by L. Schöney.

7. Seeds of *Orthocarpus purpurascens* : by Edward G. Day.

8. California Gold-Sand : by Edward G. Day.

9. The Diamond Beetle, *Entimus imperialis* : by Mark H. Eisner.

10. Arranged Diatoms : by Mark H. Eisner.

11 and 12. Cyclosis : by F. W. Devoe.

13. Circulation of Blood in the Tail of a Newt : by F. W. Devoe.

14. *Bugula avicularia*, a marine Polyzoan : by A. S. Brown.

15. Foot of the Water-Beetle, *Dytiscus marginalis :* by A. H. Sleigh.

16. Radula of the Conch, *Sycotypus canaliculatus*, Gill : by J. L. Zabriskie.

17. Insects in fossil Gum Copal, from Zanzibar, Africa : by George E. Ashby.

18. Hair of a Mouse : by Wilson Macdonald.

19. Lace-Bark, from the Lace-Bark Tree, *Lagetta linearia :* by Edwin B. Grove.

20. Living Desmids : by Edgar J. Wright.

21. Seeds of Portulaca : by W. R. Mitchell.

22. Spore-cases and Spores of the Fern, *Anemia Mexicana :* by Henry M. Dickinson.

23. *Polycystina*, from Barbadoes : by Henry M. Dickinson.

24. Mouth-parts of a Mosquito : by F. W. Leggett.

25. Cilia of a Mussel : by J. D. Hyatt.

26. Portion of wing of the Blue Butterfly, *Morpho Menelaus :* by Charles S. Shultz.

27. Brownian Movement : by Charles F. Cox.

28. " File " of Katydid, *Platyphyllum concavum*, Harris : by Benjamin Braman.

29. A piece of the Skin of a Dog-Fish, *Acanthias :* by Walter H. Mead.

30. Circulation of Blood in the Frog : by J. L. Wall.

31. Leaf of the *Deutzia scabra :* by W. E. Damon.

32. Bouquet, formed of Scales from the Wings of Butterflies : by C. W. Brown.

33. Transverse section of the Thistle, *Carduus :* by F. Collingwood.

34. *Leucite*, in lava from Vesuvius, Italy : by A. Woodward.

35. Crystals of Silver : by M. M. LeBrun.

36. Transverse section of Hair, from an Elephant : by Horace W. Calef.

37. Diatoms. Type-Plate of 183 forms, from the *Holothuridea* of Java : by E. A. Schultze.

38. Diatoms. Type-Plate of 195 forms, from the *Holothuridea* of Sumatra : by E. A. Schultze.

39. Diatoms. Type-Plate of 378 forms, from the *Holothuridea* of the China Sea: by E. A. SCHULTZE.

40. Objects from fresh-water Aquaria: by WILLIAM G. DEWITT.

41. Markings on a Diatom: by WILLIAM WALES.

42. Illuminating organ of the Glow-Worm, *Lampyris noctiluca*: by T. CRAIG.

43 and 44. Compound eye of Peacock Butterfly, *Vanessa Io*, shown in consecutive sections: by LUDWIG RIEDERER.

45. Scale of the Amber-Fish: by KENNETH F. JUNOR.

46. Tongue of House-fly, *Musca domestica*: by C. W. MCALLISTER.

47. Stamens and Pollen of the Mallow, *Malva rotundifolia*: by WILLIAM BEUTTENMÜLLER.

48. *Foraminifera*, from New Jersey: by JAMES WALKER.

49. Section of Granite: by T. B. BRIGGS.

50. Section of "Quill" of the Porcupine, *Hystrix cristata*: by E. B. SOUTHWICK.

51 and 52. Termites, or White Ants, from Colon, South America: by P. H. DUDLEY.

MEETING OF MARCH 2D, 1888.

The President, Mr. Charles F. Cox, in the chair.

Twenty-three persons present.

OBJECTS EXHIBITED.

1. The longitudinal-radial section of the wood of the Sugar Pine, *Pinus Lambertiana*, Dougl.: by J. L. ZABRISKIE.

2. Section of Coal, showing woody structure: by P. H. DUDLEY.

3. Section of *Chlorastolite*, from Isle Royal, Lake Superior: by JAMES WALKER.

4. Thread-cells, from tentacle of Portuguese Man-of-War, *Physalia pelagica*: by CHARLES F. COX.

5. Thread-cells, of the Bermuda Madrepore, *Isophyllia dipsacea*: by CHARLES F. COX.

6. Skin of Chameleon: by J. D. HYATT.

7. The Lord's Prayer, written by Mr. Webb, of London: by C. S. SHULTZ.

OBJECTS FROM THE SOCIETY'S CABINET.

8. Hair of Rat.

9. Hair of Badger.

THE BLACK CROSS OF THE SUGAR PINE.

The Rev. J. L. Zabriskie : "The object exhibited is the longitudinal-radial section of the wood of *Pinus Lambertiana*, Dougl., the Sugar Pine of the western slopes of the mountains on the Pacific coast. The popular name is due to an occasional use of a sweet exudation from the stump of the tree, as a substitute for sugar.

"I desire to mention especially the appearance of the 'lenticular markings' of the section, as shown by polarized light. These markings are in the Sugar Pine about .001 of an inch in diameter—the largest of any of the coniferæ, as far as I am aware. By polarized light—in common with the similar markings in all the coniferæ—they show a distinct, diagonal, black cross. But, either on account of their large size, or some peculiarity of their structure, the black cross is shown with unusual distinctness in the markings of this tree.

"Dr. Thomas Taylor, of the Agricultural Department at Washington, has called my attention to the fact of the similarity of this cross to the cross of the crystals of butter. If you turn to his beautiful representations of the photomicrographs of the butter crystal, in the *American Monthly Microscopical Journal*, for August, 1887, you will see how striking this similarity is.

"I take pleasure in donating the slide to the Cabinet of the Society."

WOODY STRUCTURE IN COAL.

Mr. P. H. Dudley : "This section was prepared by the late Dr. Allen Y. Moore. The woody structure shown is identical with that of *Sequoia gigantea*, the Giant Tree of California."

The President, Mr. Charles F. Cox, read a Paper, entitled "Notes on the Thread-cells of certain cœlenterate Animals," which Paper is published in this number of the JOURNAL, p. 131.

Mr. J. D. Hyatt, in remarking upon his exhibit, stated that the prominences upon the skin of the Chameleon are not, properly speaking, papillæ, but scales, which are covered with smaller scales, and that these smaller scales are marked with fine dots, averaging about 4,500 to the linear inch ; that each main scale, in those parts of the body where change of color appears, has a rib, like a stout spine, embedded longitudinally in its outer surface ; and that the change of color is produced by the elevation

and depression of these spines, causing a change in form of the surface of the scales.

A "WEBB" WRITING OF THE LORD'S PRAYER.

Mr. Charles S. Shultz stated that the slide exhibited by him, the property of Mr. Stephen Helm, was written by Mr. Webb, of England, and that, with the use of letters of the same size, twenty Bibles could be written in the space of a square inch.

In the London *Monthly Microscopical Journal*, October, 1876, p. 172, it is recorded, that Mr. Frank Crisp of London had then in his possession a diamond engraving of the Lord's Prayer, written at the rate of fifty-nine Bibles to the square inch.

CONTINUOUS CENTERING OF A COVER-GLASS.

The Rev. J. L. Zabriskie: "I find that a very satisfactory method for the continuous centering of a cover-glass, for subsequent operations with the self-centering turn-table, with either a glycerine or a balsam mount, when no cell is employed, is to run a very delicate ring of india-ink with a fine pen upon the upper, or clean side of the glass slip, while the slip is revolving upon the turn-table, and one thirty-second of an inch larger than the cover about to be used, as the first step in the operation of mounting.

"I have heard of such rings being employed on the under side of the slip. But very few of the latter are such accurate parallelograms that a ring on the under side will be central for the upper side, because, when the slip is turned over, it is liable to be held on the turn-table by the pair of diagonal corners, which were not employed in the first instance. And moreover when the ring is run on the under side, the thickness of even a thin slip renders difficult the subsequent centering of a cover by sight.

"If the ring of ink is run on the clean side of the slip it is accurately centered for each subsequent operation; the cover can be centered within it accurately without returning to the turn-table; and if the application of a spring-clip causes the cover to slide, the latter can still be immediately readjusted by sight.

"The india-ink dries at once, and does not, as might be supposed, cause any practical difficulty by running in under the

cover-glass. In case of a glycerine mount, if there is excess of glycerine around the cover, a small stream of cold water, used to wash away the excess of glycerine, also instantly carries away the ring of ink. If there is no excess of glycerine the ring of ink may be left, and it will be entirely hidden by the sealing of the mount, if any dark colored cement is used. In case of a balsam mount the ring of ink will be scraped away when cleaning the slide, or if there is no excess of balsam, it may be quickly removed, when the mount has hardened, by the moisture of the breath and gentle rubbing with a handkerchief."

Meeting of March 16th, 1888.

The President, Mr. Charles F. Cox, in the chair.

Twenty-five persons present.

Dr. William S. Gottheil, Dr. Paul Hoffman and Mr. William E. Simpson were elected Resident Members; and Dr. R. H. Ward was elected a Corresponding Member of the Society.

OBJECTS EXHIBITED.

1. Section of palpus of *Pieris oleracea*, Harris, showing organ of smell: by L. Riederer.

2. Section of palpus of *Pieris rapæ*, Schrank, showing organ of smell: by L. Riederer.

3. Transverse section of Hair of Horse, $\frac{1}{1600}$ of an inch thick: by J. L. Zabriskie.

4. Longitudinal section of Hair of Horse, $\frac{1}{1600}$ of an inch thick, showing medulla, cortex and external scales: by J. L. Zabriskie.

5. Leaf of *Croton tiglium*, showing hairs *in situ*: by Kenneth F. Junor.

6. Transverse section of spine of *Echinus cidaris*: by Kenneth F. Junor.

7. Section of *Monazite*: by T. B. Briggs.

8. Section of pebble from Chagres River, the quartz containing fluid inclusions, each having a moving vacuole: by P. H. Dudley.

9. Musical organs of the Seventeen-year Harvest-fly, *Cicada septendecim*, L.: by F. W. Leggett.

ORGANS OF SENSE IN THE PALPUS OF PIERIS OLERACEA, HARRIS.

Mr. L. Riederer read the following description of his exhibit:

"The labial palpi of *Pieris oleracea*, Harris, are three-jointed, and bent upward, and are covered, especially on the forward edge, with long, narrow, feather-like hairs. They are so long that they overreach the head, and between them the maxillæ are rolled up when not in use.

"In the distal end of the last joint, which is much smaller than the other two joints, is an opening leading to a tube, which finally widens into a chamber of the shape of a segment of a sphere. The inside of the tube is covered with short hairs, or bristles, all pointing towards the opening as if to bar intruders from entering. The chamber shows a surface of disks, each one of which bears in the middle of a depression an articulated, fine hair. Below the surface, corresponding to each one of these disks, are ganglion cells with nucleus and nucleolus. From this layer of ganglion-cells a nerve-connection runs down the palpus.

"In comparing the structure of this organ with corresponding organs of other insects, and organs of higher animals, there appears a striking similarity to the organ of smell. But it cannot be overlooked that the organ of smell is, in animals generally, exposed where, most likely, large volumes of air are to pass, while here such opportunity is not apparent. Muscles may distend and contract the cavity, and perhaps may augment in this way the changing of air.

"*Pieris rapæ*, Schrank, shows similar arrangements.

"Dimensions were observed as follows :

Palpus: 1st joint, length,	1.3 mm.;	width,	0.4 mm.
2d " "	1.3 mm.;	"	0.4 mm.
3d " "	0.37 mm.;	"	0.1 mm.
Cavity : full depth,	0.16 mm.		
Chamber : width,	0.05 mm.		
Disk : diameter,	0.009–0.012 mm.		
Sense-hairs : length,	0.024 mm.		
" " diameter,	0.0018 mm."		

SECTIONS OF HAIR OF THE HORSE.

The Rev. J. L. Zabriskie : "The sections are from hair of the tail of the Horse, jet-black in color, and of very dense, solid

structure. Streaks of black pigment appear in the longitudinal section. This section, lying in a plane slightly removed from the longitudinal axis of the hair, shows the external scales upon the narrow inclined edges. I take pleasure in donating both slides to the Cabinet of the Society."

The Rev. Kenneth F. Junor, gave a very interesting résumé of the structure and habits of *Echinus*, illustrating his remarks by the exhibition of a number of specimens.

Meeting of April 6th, 1888.

The Vice-President, Mr. P. H. Dudley, C. E., in the chair.

Twenty-eight persons present.

Dr. R. W. St. Claire, and Mr. J. W. G. Angell were elected Resident Members of the Society.

OBJECTS EXHIBITED.

1. Pond Life: by Charles S. Shultz.
2. Meteorite, containing Diamonds, from Novy Urej, Krasnoslobodsk, Siberia: by George F. Kunz.
3. Transverse section of Bone, from the Vertebral Plate of the Finback Whale, *Sibbaldius tectirostris*, Cope: by J. L. Zabriskie.
4. *Acraspeda*, a Discomedusa: by Ludwig Riederer.
5. *Rhopalonema*, a Trachomedusa: by Ludwig Riederer.
6. Orchid-seeds: by N. L. Britton.
7. Section of Fossil Wood, from California: by T. B. Briggs.
8. Photomicrographs of multiple image in the eye of the Roach, photographed by J. Lee Smith: by F. W. Leggett.
9. The August Becker Sledge-Microtome: by Ludwig Riederer.

OBJECTS FROM THE SOCIETY'S CABINET.

10. Diatoms from the Sandwich Islands.
11. Specimens of Corallines.

METEORITE CONTAINING DIAMONDS.

Mr. George F. Kunz being absent, the following explanation of his exhibit, furnished by him, was read from the chair:

"Small pieces of the Novy Urej, Krasnoslobodsk, Siberian

Meteorite were boiled, first in nitric acid, then in sulphuric, and finally in nitro-muriatic acid. This removed the iron, magnetite, olivine, enstatite, etc., leaving, as a residue, some small, transparent bodies, twelve in all. I herewith exhibit some of these. One, which was unfortunately lost, was either a cube, with faces of the tetro-hexahedron, or else a distorted trigonal tris-octahedron. These exhibited are very much distorted, and two resemble the latter form. This is one of the principal forms of the Diamond. The colors are either pink or light brown. The size has prevented me from trying the hardness. But, having scratched nine sapphires with pieces of the Meteorite, producing the fine, delicate lines characteristic of the Diamond, there can be little doubt that these bodies, the only residue, were those which produced the scratches."

SECTION OF BONE OF THE FINBACK WHALE.

The Rev. J. L. Zabriskie :

"The specimen is taken from bone, collected from the skeleton of a Finback Whale, 62 feet long, which was brought ashore and cut up for oil at Fisher's Island, at the eastern extremity of Long Island Sound, in 1869.

"The skeleton of the Whale is remarkable for the pairs of vertebral plates, or epiphyses, situated between the vertebral joints. These plates never become consolidated with the body of the adjoining bone, as they do usually in other mammalia. They have one surface nearly flat, and deeply pitted for the attachment of cartilage, and have the other surface slightly convex and comparatively smooth. The flat, rough surface is turned towards, and is attached to its own joint of the vertebral column; while the convex, smooth surface is opposed to, and articulates with the convex surface of another plate, belonging to the succeeding vertebra.

"The plate here exhibited, from which the section was taken, was situated towards the hinder extremity of the skeleton. It is comparatively small, being about ⅞ of an inch thick by 10 inches in width, over its longer diameter. In the thorax of the same skeleton the plates were much larger. For they correspond in size with the diameter of that portion of the vertebral column to which they belong.

"The bone is remarkably light and porous. The pores are so large and abundant that they give the appearance of a miniature honey-comb, and pass directly through the substance of the bone, parallel with the longitudinal axis of the vertebral column, leaving only a thin shell of solid bone at either surface of the plate. These pores are slightly flexuous, frequently branched, usually of an elliptical outline in transverse section, frequently $\frac{1}{40}$th of an inch in diameter, and occasion an extreme example of porosity of bone structure."

THE MEDUSÆ.

Mr. Ludwig Riederer read the following note in explanation of his exhibits of Medusæ :

"Another order of the *Polypomedusæ* is formed by the DISCOMEDUSÆ. These are Medusæ of considerable size—the edge of the umbrella lobed—the sense-organs covered. The umbrella is thick ; its gelatinous connective tissue is richly developed, and contains a quantity of strong fibrillæ and a net-work of elastic fibres, which structures confer upon it great firmness. The edge of the umbrella is divided by a regular number of indentations, usually into eight groups of lobes, between which the sense-organs are contained in special pits.

"The flat disk of the *Ephyra*, which is split into eight pairs of lobes, contains a central gastric cavity, into which the canal of the short, wide, four-cornered mannorium leads. From this central cavity there diverge eight canal-like, peripheral diverticula (radial pouches), between which there are found the same number of short, intermediate canals (intermediate pouches). At the gastric cavity are placed worm-like, movable tentacles, not found in any *Hydromedusæ*. The marginal bodies, as well as the pit-like depressions (olfactory pits), on the dorsal side of the excavations, in which the marginal bodies are placed, must be considered as sense-organs. They appear in all cases to unite the functions of ocular and auditory apparatus. The auditory function is provided for by a large sack, which originates from the cells of the entoderm, and contains crystals. The eye consists of a mass of pigment, lying on the dorsal, or ventral side near the end of the stalk.

"TRACHYMEDUSÆ : These have a body-like cavity, which

serves alike for circulation and digestion (gastro-vascular space). The tissues are consistent—not pierced by a system of pores. The osculum is replaced by a mouth, with thread-cells in the epithelial tissues.

"The *Polypomedusæ* have an œsophageal tube, with simple gastro-vascular cavity. The generative elements are developed in medusoid forms, which may be either free-swimming, or permanently attached to hydroid forms.

"The *Trachymedusæ* are Medusæ with a firm, gelatinous umbrella, supported by cartilagenous ridges, with stiff tentacles, filled with solid rows of cells. These may be confined to the young stage. Development takes place by metamorphosis, without hydroid, asexual individuals. The family *Trachynemidæ*, to which *Rhopalonema* belongs, is characterized by stiff marginal tentacles, which are scarcely capable of motion. The genital organs are developed on vesicle-like swellings of the eight radial canals."

Dr. N. L. Britton explained with drawings on the black-board the main points of his exhibit—Seed-coats of the Orchid, *Habenaria Hookeri*, Torr.

Dr. Britton also donated to the Library of the Society the following publications: Ten numbers of the *Bulletin de la Société Belge de Microscopie;* Memoir of the Rev. Elisha Mitchell, D. D.; and *Journal of the Elisha Mitchell Scientific Society*, for 1883–84, and 1884–85.

Mr. Ludwig Riederer explained the mechanism and method of operating the August Becker Sledge-Microtome, exhibited by him.

Mr. Charles S. Shultz introduced the Rev. E. C. Bolles, D.D., of New York city, who tendered his congratulations to the Society.

The Vice-President announced from the chair that Dr. H. Hensoldt, an expert lithologist, was expected to illustrate his methods of preparing rock-sections before the Society at the next meeting.

Mr. William Wales announced the death of Mr. Joseph Zentmayer, of Philadelphia, and followed the announcement with remarks eulogistic of the character and work of the deceased.

On motion, the chair appointed the following committee to

draft resolutions relating to the death of Mr. Zentmayer: William Wales, N. L. Britton, J. L. Zabriskie.

MEETING OF APRIL 20TH, 1888.

The President, Mr. Charles F. Cox, in the chair.

Forty-nine persons present.

Prof. E. G. Love, Ph.D., and Mr. J. T. C. Grow were elected Resident Members of the Society.

OBJECTS EXHIBITED.

1. Nephelinite, Odenwald, Germany.
2. Luxulyanite, Cornwall, England.
3. Tachylite, Giessen, Germany.
4. Augite—lava, Nassau.
5. Olivine—serpentine, Saxony.
6. Foraminiferous Limestone, Kent, England.

These six objects were prepared and exhibited by DR. H. HENSOLDT in illustration of his address, delivered at this meeting.

7. Transverse and longitudinal sections of the Hair of the Prong-horn Antelope, *Antilocapra Americana*, Ord: by J. L. ZABRISKIE.

8. *Candeina nitida*, d'Orbigny, found in the North Atlantic and in Torres Straits : by A. WOODWARD.

9. Crystals of Meconic Acid: by C. F. COX.

10. Films of Silicate of Soda: by C. F. COX.

11. A Sertularian: by W. E. DAMON.

12. Human Blood in a Current-Slide: by DR. D. S. HOLMAN.

Dr. H. Hensoldt, Lithologist, was introduced to the Society, and delivered an Address entitled "The Microscopical Investigation of Rocks." This Address is published in this number of the JOURNAL, p. 139.

Dr. Hensoldt also, by means of specially devised apparatus, exhibited before the Society the operations of slicing, grinding and polishing minerals, and explained his methods of mounting thin mineral sections.

On motion, the thanks of the Society were tendered Dr. Hensoldt for this Address and demonstration.

HAIR OF THE PRONG-HORN ANTELOPE.

The Rev. J. L. Zabriskie: "This animal has become celebrated on account of admirable published descriptions of its structure and habits, and also on account of its frequent domestication, in his private grounds, by the Hon. John D. Caton, of Chicago, Illinois.

"The creature stands alone, the only species of its genus. Its horns are hollow, and yet are shed at regular intervals, so that it fills a gap in classification between the ruminants, which have hollow, persistent horns, and those which have them solid and deciduous. Its habitat is confined to the New World, and to a very limited portion of our own country—the dry gravelly regions west of the upper waters of the Missouri river.

"The hair on most portions of its body shows in extreme degree the characteristics usually found in the deer-family—a large diameter compared with the length, and the interior filled with a copious medulla, consisting of very large cells, leaving only a thin cylinder of cortex, thus allowing the hair, between the root and the suddenly attenuated point, to bend easily without breaking.

"The specimens exhibited were taken from a dried hide, attached to a piece of the skin, cut from the margin of the bullet-hole, where the missile had entered which killed the animal. The hairs were deeply stained with blood. I was informed that it had been found impossible to wash this blood from the hairs. The sections show the reason of this to be the fact that the blood does not cling to the surface of the hairs, but has penetrated and still occupies the large cells of the medulla.

"I take pleasure in donating the slide to the Cabinet of the Society."

INORGANIC FORMS RESEMBLING DIATOMS.

Mr. Charles F. Cox: "The slides which I exhibit contain inorganic forms most strikingly resembling Diatoms and their markings. One exhibit consists of crystals of Meconic Acid from opium, and the other of films of Silicate of Soda."

Dr. Holman, of Philadelphia, on request, addressed the Society on the construction and operation of the Current-Slide,

devised and exhibited by him, illustrating his remarks by drawings on the black-board.

Dr. Holman said that the old fashioned concave slide allowed speedy evaporation, but on his slide *Protococcus* may be kept alive many days; *Amœba*, three weeks; and Bacteria for six months. In the minute canal, $\frac{1}{100}$ inch wide and $\frac{1}{1000}$ inch deep, between the two concavities with shallow margins in his slide, blood corpuscles may be caused to flow in either direction, to roll over, or to stand on edge by the warmth of the hands of the operator, brought towards the stage of the microscope at a distance of about six inches.

On motion, the thanks of the Society were tendered Dr. Holman for his exhibit and explanation.

Meeting of May 4th, 1888.

The President, Mr. Charles F. Cox, in the chair.

Forty-six persons present.

OBJECTS EXHIBITED.

1. The living Beetle, *Zopherus, mexicanus*, Sol., "Makeche."

2. The mandibles of the dead Beetle.

3. Metal cover, in which the Beetle had cut and enlarged the holes made for ventilation.

4. The metal cuttings.

5. Diagrams of the head and mandibles of the Beetle, and photographs of the cuttings, etc.

These five exhibits were by Mr. F. W. Devoe, in illustration of his Paper, read at this meeting.

6. Fore leg of the Beetle, *Harpalus Pennsylvanicus*, Deg., showing the "Brush and Comb:" by J. L. Zabriskie.

7. Larva of *Psephenus Lecontei*, Hald. (an aquatic Beetle), found at Delaware Water Gap: by A. Woodward.

8. A collection of Beetles from Yucatan: by Edgar J. Wright.

9. A collection of Beetles from New York City: by Edgar J. Wright.

10. *Belostoma Americana*, captured in New York City: by F. W. LEGGETT.

11. A Beetle in amber: by JAMES WALKER.

12. A collection of Beetles from China: by K. F. JUNOR.

Mr. F. W. Devoe read a Paper, entitled "The Beetle, *Zopherus mexicanus*, Sol., cutting metal," and illustrated by objects, as announced above. This Paper is published in this number of the JOURNAL, p. 145.

Professor Samuel Lockwood, Ph. D., read a Paper, entitled "On the Larva of the Stag-Beetle, eating Rail Road Ties." This Paper is published in this number of the JOURNAL, p. 147.

"BRUSH AND COMB" OF THE FORE LEG OF THE BEETLE, HARPALUS PENNSYLVANICUS, DEG.

The Rev. J. L. Zabriskie: "On the inner edge, and near the distal extremity of the tibia of the fore leg in this Beetle is seen a large, movable spine, lying over and extending beyond a gently curved notch fringed with hairs, which apparatus is doubtless intended for cleaning the antennæ.

"Eleven years ago I published in the *American Journal of Microscopy*, vol. II (1877), p. 77, an article, applying the name "Brush and Comb" to a similar apparatus in the Hymenoptera.

"This is found in all the Hymenoptera, excepting a few of the lower genera, as a striking feature of the external structure. There need be no mistake concerning its use in the Hymenoptera. As far as I am aware this use is most clearly seen in the case of our common paper-making wasps, *Polistes anularis*, Fab., and *P. metricus*, Say. When these wasps alight they habitually employ part of the time in cleaning the antennæ, by throwing a fore leg over the adjoining antenna, catching the antenna between the notch and spine of the leg, and, by a downward movement of the leg, drawing the antenna through the circular opening formed by this apparatus. After this has been repeated a few times the leg is cleaned, by being drawn through the mandibles, and thoroughly washed off with vigorous motions of the mouth-parts.

"There is this difference to be noted in the form of this apparatus in the Hymenoptera, and in the case of this Beetle. In the Hymenoptera the spine is situated near the distal end of the

tibia, and the notch near the proximal end of the adjoining large tarsal joint. While in this Beetle the spine and notch are both situated on the tibia near the distal end."

VITALITY OF THE LARVA OF DERMESTES.

Mr. F. W. Leggett announced the death of his Larva of *Dermestes*, which had withstood, for five months and twenty days, solitary confinement in a closed cell, and had subsisted during that period upon its own cast skins, having moulted five times.

Mr. George F. Kunz donated, for distribution among the Members, a packet of eleven varieties of Textile Fibres, received from the National Museum, Washington, D. C.

PUBLICATIONS RECEIVED.

The Botanical Gazette: Vol. XIII., Nos. 3–5 (March–May, 1888).

Entomologica Americana: Vol. III., No. 1, Vol. IV., No. 2 (March–May, 1888).

The Microscope: Vol. VIII., Nos. 3–5 (March–May, 1888).

The Microscopical Bulletin and Science News: Vol. V., Nos. 1, 2 (February, April, 1888).

Bulletin of the Torrey Botanical Club: Vol. XV., Nos. 3-5 (March–May, 1888).

Journal of Mycology: Vol. IV., Nos. 2–5 (February–May, 1888).

The Natural Science Association of Staten Island: Proceedings of March 10, April 14, May 12, 1888; Special No. 7 (May, 1888).

Bulletins of the Agricultural College of Michigan· Nos. 35, 36.

Anthony's Photographic Bulletin: Vol. XIX., Nos. 5–10 (March 10–May 26, 1888).

The West-American Scientist: Vol. IV., Nos. 33–36 (January–April, 1888).

The Brooklyn Medical Journal: Vol. I., Nos. 2–5 (February–May, 1888).

The Hahnemannian Monthly: Vol. XXIII., Nos. 1–6 (January–June, 1888).

"Psyche:" Vol. V., Nos. 141-145 (January–May, 1888).

Indiana Medical Journal: Vol. VI., Nos. 9–12 (March–June, 1888).

The Swiss Cross: Vol. III., Nos. 1–6 (January–June, 1888).

Journal of the Trenton Natural History Society: No. 3 (January, 1888).

Transactions of the Massachusetts Horticultural Society: 1887, Part I.

Journal of the Elisha Mitchell Scientific Society: 1887, Part II.

JOURNAL

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LIVING ACTINIA, OR SEA-ANEMONES.

BY WILLIAM E. DAMON.

(*Read June 15th*, 1888.)

These animals, inhabiting only salt water, are found upon almost every sea-coast in the world, attached to rocks, logs, algæ, and any object that will serve them as anchorage. They can be found better at low water, on the rocks or piles, which they sometimes so thickly cover as to hide the object, on which they are tenaciously adhering by their suctorial base, appearing like a living flower-garden.

It would be difficult to exaggerate in speaking of the beauty of these flower-beds, as they may well be called. The vivid tints which they often display, and the gracefulness of their form, with their moving tentacles ever on the alert for food, make them always objects of fascinating study.

Their history is long and interesting. However, I do not propose to enter into minute histological detail, for the time would not allow this, and such detail would be out of place in a general sketch like the present. I will only say a few words more particularly about their life and habits.

For a long time, even until a few years ago, it was questioned whether they were plants or animals. But that these very interesting objects are animals there now is no doubt. Their structure consists of a sac, divided by vertical partitions into distinct cavities or chambers. These partitions are not all formed at once in the Anemone. First there are six chambers, all opening into a corresponding number of tentacles, then come twelve, twenty-four, forty-eight, and so on, each division mean-

ing another set of tentacles on the crown or head of the Anemone arranged around the mouth, which occupies the center of these soft waving tentacles, all forming the flower-like shape, from which they very appropriately take their name.

The body may be described as a circular, gelatinous bag, the bottom of which is quite flat, sometimes spreading unevenly around the margin. The upper edge of this bag is turned in, so as to form a sac within a sac. The inner sac is the stomach, or digestive cavity, with an aperture in the bottom, through which the food can pass into the outer cavity. The eggs are attached to, and hang on the inner edge of the partitions, and, when mature, they drop into the main body-cavity, and enter the inner digestive sac, through the hole in its lower portion, and are passed out through the mouth. The creature, however, does not ignominiously eject its young. The little ones are very tenderly taken from its mouth by two tentacles, which become wonderfully elongated for the occasion, and with their prehensile touch each young Anemone, now perfect in form and all its functions, no larger than a pin's head, is carefully and slowly let down, and deposited upon the rock around the base and close to the mother Anemone, and where these, which I show you to-night, have remained ever since their birth, some six weeks ago.

They may remain for some time in one place, tenaciously adhering by their base. They are, however, capable of motion, and are very likely to move about from one spot to another. I have seen them move clear across the tank in a few hours. This movement is effected by a double set of muscles, one running around the body, and the other arranged longitudinally.

I have brought with me to-night one of these animals and her young. This species is named *Actinia mesembryanthemum.* I have fourteen young Anemones, all born in my aquarium since my return from Bermuda, March 12th last, their ages varying from three months down to the youngest, which was born last Monday, and which you can see here under the microscope. These little ones vary in color from light pink to bright scarlet, red, dark blue, and almost black. This youngest Anemone, however, like most all favorite children, I believe, is a wonderful child! As you will see, it already has its second row of tentacles, numbering twelve, and it is only five days old!

We will now speak of its method of feeding, *etc.* The young have the same means of warfare and defense as those possessed by their parents—poisoned arrows, or lasso-cells, sometimes called cnidæ, or nematocysts, thread-cells, *etc.* These weapons are cells, imbedded in the outer skin-substance, filled with fluid, and containing a long and delicate projectile thread, capable of being shot out with considerable force and inconceivable rapidity. These threads bury themselves in any object against which they may be directed, and probably convey into the wound some poisonous matter, thus rendering their prey a helpless victim to their greedy mouths.

These animals also have a sense of taste, their likes and dislikes, the sense of smell, and eyes—only rudimentary eyes, however, and probably not of much use. They are very voracious, the little ones especially so. I feed mine with small pieces of oyster or clam, or fresh meat, scraped fine and dropped into the water over them, where every piece is seized by their outstretched arms or tentacles, and passed hurriedly to their mouths. The daintiest food for them, however, is the small oyster-crab, which we sometimes find in the oyster-shell. On this they fairly revel. An Anemone, like this one in the glass jar, easily disposes of a whole crab at a meal.

PROCEEDINGS.

Meeting of May 18th, 1888.

The President, Mr. Charles F. Cox, in the chair.

Thirty-two persons present.

OBJECTS EXHIBITED.

1. Spicules of *Synapta*, from New Zealand: by Charles F. Cox.

2. Mouth-parts of Belostoma Haldimanum: by F. W. Leggett.

3. Section of Itacolumnite (Flexible Sandstone), from North Carolina: by James Walker.

4. Parts of *Echinus*: by K. F. Junor.

5. A group of *Bryozoa*: by W. E. Damon.

The Report of the Committee, appointed to draft resolutions relative to the death of Mr. Joseph Zentmayer, was adopted, as follows:—

Whereas this Society has received with sorrow the announcement of the death of Mr. Joseph Zentmayer, which occurred at Philadelphia, Pa., on March 28th, 1888, it is hereby

Resolved:—

1. That in the death of Mr. Joseph Zentmayer the laborers in the various branches of science employing optical instruments have lost the inspiriting presence and helpful coöperation of an eminently intelligent and successful author, inventor and mechanician, whose knowledge of optical principles has been attested by his brilliant publications, whose attainments have been recognized by his election to membership in various organizations, and whose mechanical skill and conscientious carefulness are still shown in the large variety of instruments issued from his establishment.

2. That a record of this action be forwarded to the family of Mr. Zentmayer as a token of our heart-felt sympathy with them in this bereavement.

William Wales.
N. L. Britton. } Committee.
J. L. Zabriskie.

The Rev. K. F. Junor read a Paper, as announced in the programme of this meeting, entitled "The Microscopical Characteristics of the Echinodermata," which Paper was illustrated by slides under several microscopes, and by numerous other specimens.

The Rev. Mr. Junor also invited the Members of the Society to attend an illustrated lecture, entitled "Life in Ponds and Ditches," to be delivered by Mr. Stephen Helm, at 160 West 29th Street, on the evening of May 24th.

The President announced the donation to the Library of the Society of a copy of "Essays on the Microscope," by George Adams, London, 1787, from Dr. W. Alfred McCorn, of the City Asylum, Wards Island, New York.

Meeting of June 1st, 1888.

In the absence of the President and Vice President, Mr. J. D. Hyatt was elected Chairman *pro tem.*

Twenty persons present.

The Rev. E. C. Bolles, D. D. was elected a Resident Member of the Society.

The Recording Secretary announced the presentation to the Members of this Society, by the Microscopical Section of the Brooklyn Institute, of Programmes and Tickets of Admission to the Annual Reception of said Microscopical Section, to be held in the Hall of the Brooklyn Institute on the evening of June 5th.

On motion, the thanks of the Society were tendered the Microscopical Section of the Brooklyn Institute for this presentation.

OBJECTS EXHIBITED,

1. A degraded Hymenopterous Insect, with veinless and fringed wings, in Gum Copal: by GEORGE E. ASHBY.
2. A Spider in Gum Copal: by GEORGE E. ASHBY.
3. An insect containing a fluid, which encloses a movable bubble, in Gum Copal: by GEORGE E. ASHBY.
4. Insects in Amber, from the Baltic Sea: by CHARLES S. SHULTZ.
5. Mouth-parts of an Ant: by L. RIEDERER.
6. Section of Mica Schist, from New York City: by T. B. BRIGGS.

INSECTS IN GUM COPAL.

Mr. George E. Ashby, in connection with his exhibits, remarked, that the main supply of Gum Copal is obtained from sand, at the depth of several feet, along the coast of Zanzibar, in localities where no trees are now found. The Gum has an oxydized and pitted surface, to which the sand does not adhere. Copal is more recent than Amber. The insects enclosed in Amber belong to extinct species, while those enclosed in Copal belong frequently to living species. The price of Gum Copal is One Dollar or more a pound, depending upon the transparency.

HABITAT OF VOLVOX.

Mr. J. D. Hyatt mentioned a pond, in a marshy tract, just beyond a ridge on the easterly side of the Harlem Railroad, and one-quarter of a mile beyond Jerome Park Station on that road, as the only place known to him in this vicinity where *Volvox* can be found in abundance.

On a late occasion Mr. Stephen Helm exhibited and distributed abundant gatherings of *Volvox*, collected by him in a small pond north of the Cypress Hills reservoir, Brooklyn, N. Y.

MEETING OF JUNE 15TH, 1888.

The President, Mr. Charles F. Cox, in the chair.

Thirty-two persons present.

OBJECTS EXHIBITED.

1. Pond-Life: by CHARLES S. SHULTZ.

2. Young Actinia, *Actinia mesembryanthemum*, from Bermuda Island, born in an aquarium: by WILLIAM E. DAMON.

3. Mouth-parts of Wasp: by LUDWIG RIEDERER.

4. Monazite Sand, from McDowell, Co., N. C.: by GEORGE F. KUNZ.

5. Monazite Sand. from Brazil, S. A.: by GEORGE F. KUNZ.

6. Inclusions in Oligoclase, from Bakersville, N. C.: by GEORGE F. KUNZ.

7. Fossil Infusoria, from Guano, prepared by J. W. Bailey: by A. WOODWARD.

8. Calcareous Marl, from an artesian well 110 feet deep, at Charleston, S. C., prepared by J. W. Bailey: by A. WOODWARD.

9. Section of *Astylospongia inornata*, from the Lower Helderberg Limestone, Rondout, Ulster Co., N. Y.: by A. WOODWARD.

10. Section of a Silicious Oyster, from Colorado: by A. WOODWARD.

On motion it was Resolved:—

1. That this Society hereby tenders its thanks to the Editor of the *New York Evening Sun* for the full and accurate reports of the proceedings of the Society which have appeared in the columns of that journal.

2. That the Corresponding Secretary be hereby directed to send a copy of these resolutions to the Editor of the *New York Evening Sun*.

Mr. George F. Kunz, in behalf of the New York Mineralogical Club, invited the Society to attend the Saturday afternoon excursions of the Club, stating that programmes would be sent to each member of the Society.

On motion it was Resolved:—

That the thanks of this Society be tendered to the New York Mineralogical Club for this invitation to participate in its excursions.

MONAZITE SAND.

Mr. George F. Kunz, in connection with his exhibits, explained the recently increased demand for monazite, on account of its use for the lately invented incandescent gas burner. This increased consumption has led to a search by the collectors and dealers in minerals in England, Germany, France, Russia, Norway and Brazil, and more especially in the United States; and so thorough has been the search, that the prices of minerals, which were considered rare a short time ago, are now quoted at one-tenth to one-hundredth of former figures. Monazite has been found at the following localities: Villeneuve, Ottawa County, Canada (a crystal of fourteen pounds and a half); Alexander County, N. C., at Milholland's Mill; Amelia County, Va. (in twenty pound lump); Norwich, Conn.; Ural Mountains; Mount Sorel (var. turnerite), Tavetch (var. turnerite), and Binnenthal, Switzerland; River Sanarka, Southern Ural; Arendal, Norway. At these localities the occurrence is of mineralogical interest only. At the North Carolina, Georgia, and Brazilian localities it can be obtained in quantity for commercial use. In the North Carolina gold gravels of Rutherford, Polk, Burke, McDowell, and Mecklenburg Counties, monazite is found in considerable quantities in small brown or greenish or yellowish brown monoclinic crystals associated with chromite, garnet, zircon, anatase, corundum, menaccanite, xenotime, fergusonite, epidote, columbite, samarskite, and other minerals. With these associations have been found several of the North Carolina diamonds; and at the Glade Mine, Georgia, diamonds have been found with the monazite, which exists in some abundance also. These localities will furnish tons of monazite within the next twelve months. The Brazilian monazite is found at Caravalhas, Bahia, where its existence was made known about eight years ago by Dr. Orville A. Derby, geologist of Brazil. It occurs in large quantities as a beach-sand, almost free from other minerals, as if concentrated. As it occurs on the coast, it can easily be shipped to any point where it is wanted, and a number of tons have been sent to the

United States. The best North Carolina zircon locality is on the old Meredith Freeman estate, Green River, Henderson County, N. C., which was leased for twenty-five years in the hands of Gen. T. L. Clingman of that State, who, as early as 1869, mined one thousand pounds of it, and during that whole period never lost faith in the incandescent properties of zirconia; but when the time of its adoption actually came, through some legal difficulties the general had forfeited his leases, and hence failed to reap his reward. In Henderson County, N. C. and in Anderson County, S. C., zircon is found in large quantities loose in the soil, as the result of the decomposition of a felspathic rock. The crystals are generally remarkable for their perfection, being distinctive of each locality, weighing occasionally several ounces. The recent demand has also brought to light the existence of enormous quantities of zircon in the Ural Mountains and in Norway. Although in Canada, in Renfrew and adjoining counties, enormous crystals have been found up to fifteen pounds each, yet they are so isolated, that it would be impossible to obtain a supply there. The new demand has brought together more than twenty-five tons of zircon, ten tons of monazite, six tons of cerite, thousands of pounds of samarskite, and tons of allanite and other minerals. As a consequence, zircon is now offered at less than ten cents a pound, monazite at twenty-five cents, and samarskite at fifty cents.

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The Botanical Gazette: Vol. XIII., Nos. 6–8 (June–August, 1888).

Entomologica Americana: Vol. IV., Nos. 3–5 (June–August, 1888).

The Microscope: Vol. VIII., Nos. 6–8 (June–August, 1888).

The Microscopical Bulletin and Science News: Vol. V., Nos. 3, 4 (June, August, 1888).

Bulletin of the Torrey Botanical Club: Vol. XV., Nos. 7–9 (July–September, 1888).

Journal of Mycology: Vol. IV., Nos. 6, 7 (June, July, 1888).

The Natural Science Association of Staten Island: Proceedings of June 9, 1888; Special No. 8 (June, 1888).

Bulletins of the Agricultural College of Michigan: Nos. 37, 38 (June-August, 1888).

Anthony's Photographic Bulletin: Vol. XIX., Nos. 11–16 (June 9–August 25, 1888).

The West-American Scientist: Vol. IV., Nos. 37, 38 (May, June, 1888).

The Brooklyn Medical Journal: Vol. I., No. 6—Vol. II., Nos. 7, 8 (June–August, 1888).

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"Psyche:" Vol. V., Nos. 146–148 (June–August, 1888).

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